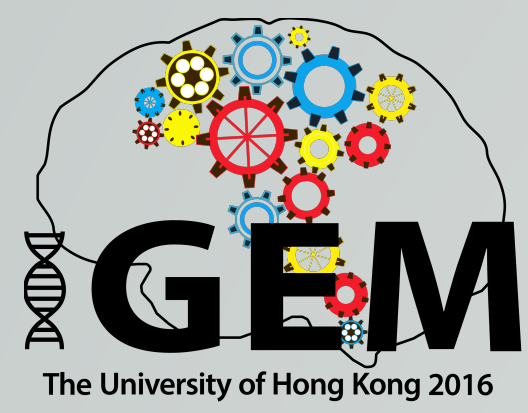


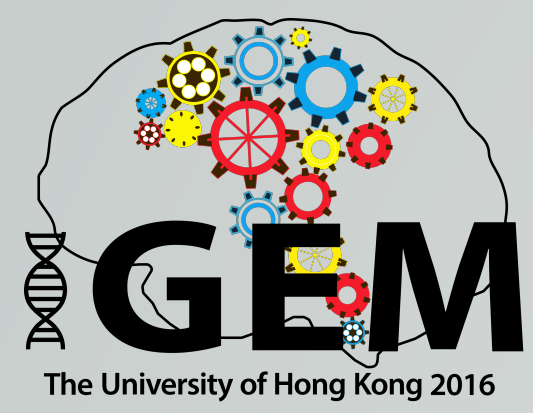




The University of Hong Kong 2016









# in-vivo synthesis of DNA nanostructures for disease diagnosis through miRNA- induced structural transformation

# **in-vivo** synthesis of DNA nanostructures for disease diagnosis through miRNA- induced structural transformation



# Design Criteria

# Design Criteria

Biocompatible

Easily modifiable

Can be synthesised by bacteria

# miRNA





# miRNA

Important in a micro way.



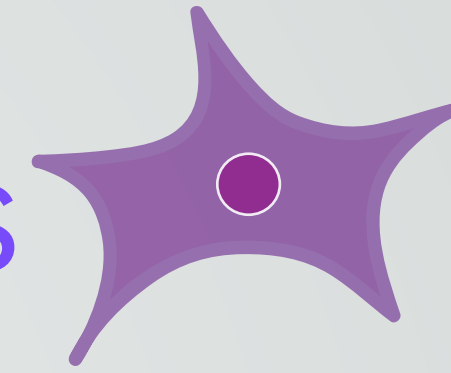
# miRNA

Important in a micro way.

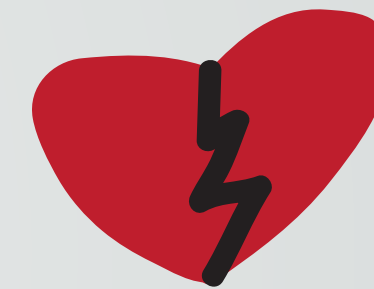
# Important biomarkers



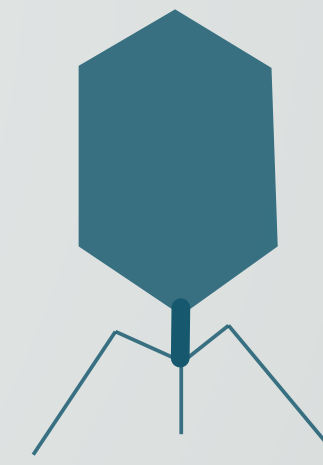
Neurological pathologies



Cardiovascular diseases



Viral infections



Many types of cancers

# miRNA

# Important biomarkers

miRNA

# Important biomarkers

miRNA

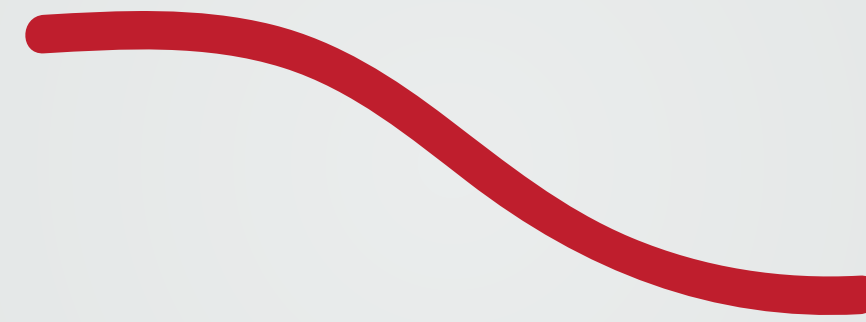


# Important biomarkers



miRNA

# Important biomarkers



~ 22nt long

# miRNA

# Important biomarkers



miRNA

# Important biomarkers

miRNA

# Important biomarkers

miRNA



# Important biomarkers

hsa-miR-34b-3p

5' - UAGGCAGUGUCAUUAGCUGAUUG -3'

Pre-manifest + ongoing Huntington's disease

miRNA

# The tetrahedron

# The tetrahedron

Seeing is believing.

# The tetrahedron

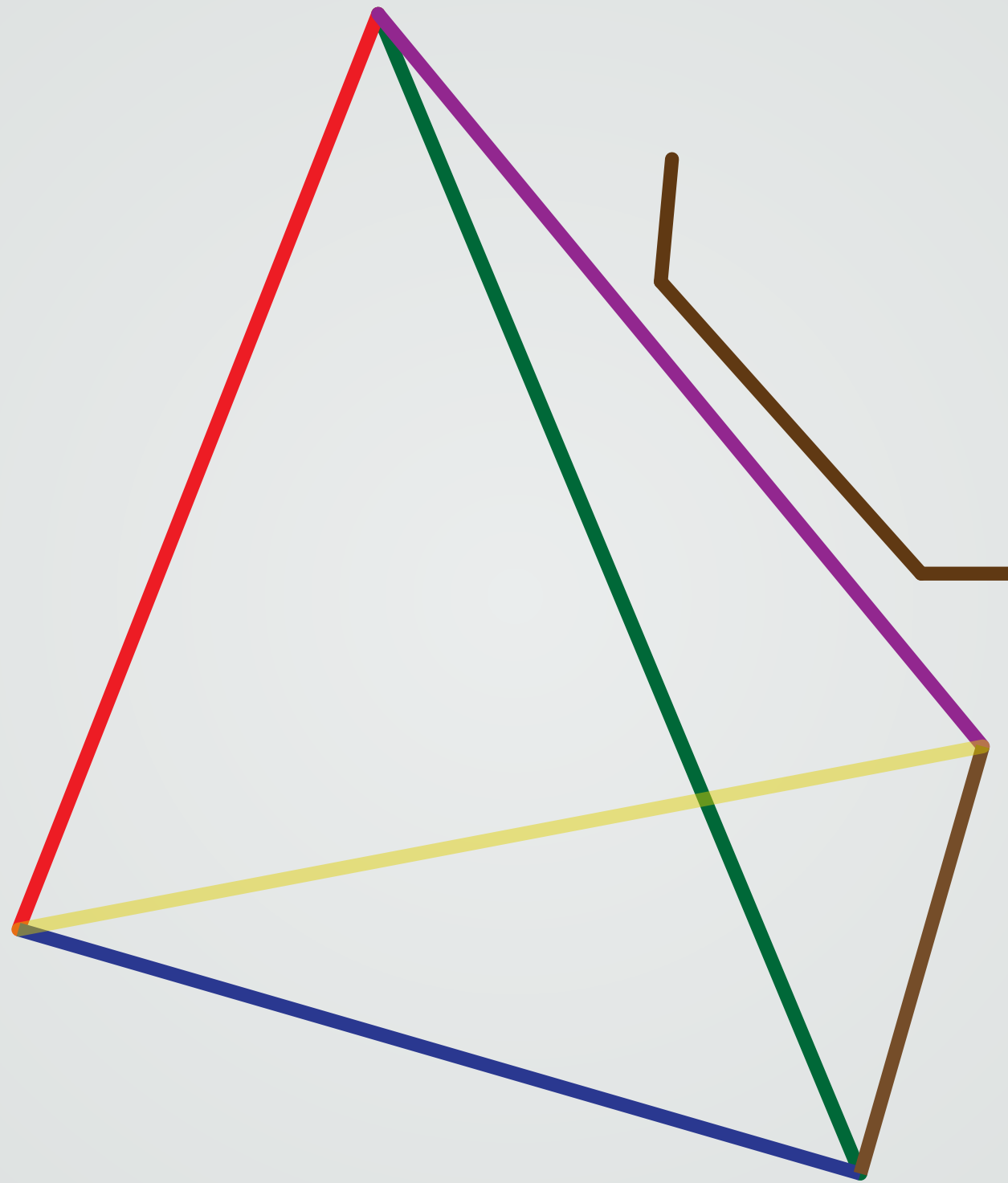
Seeing is believing.



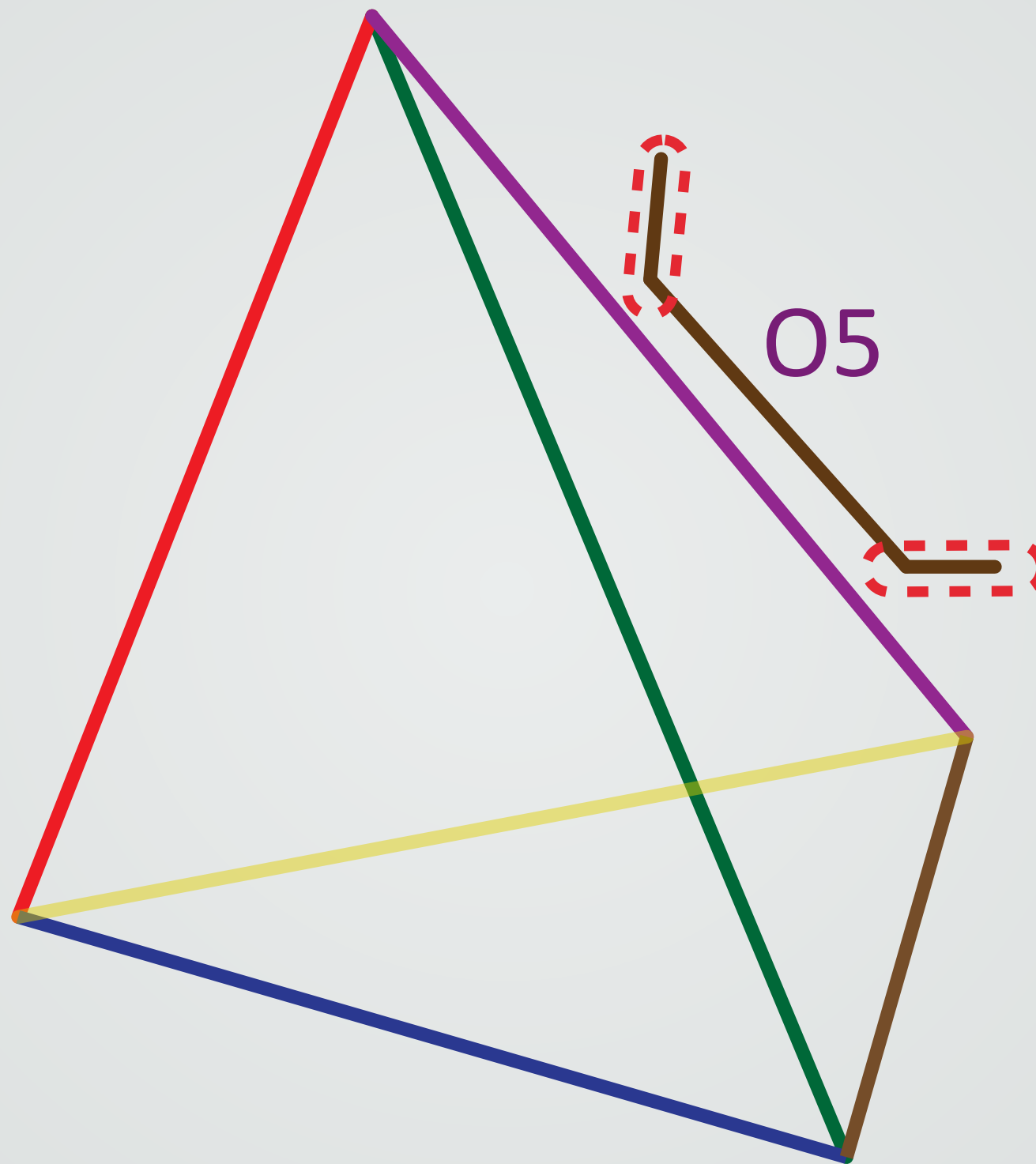
# The tetrahedron



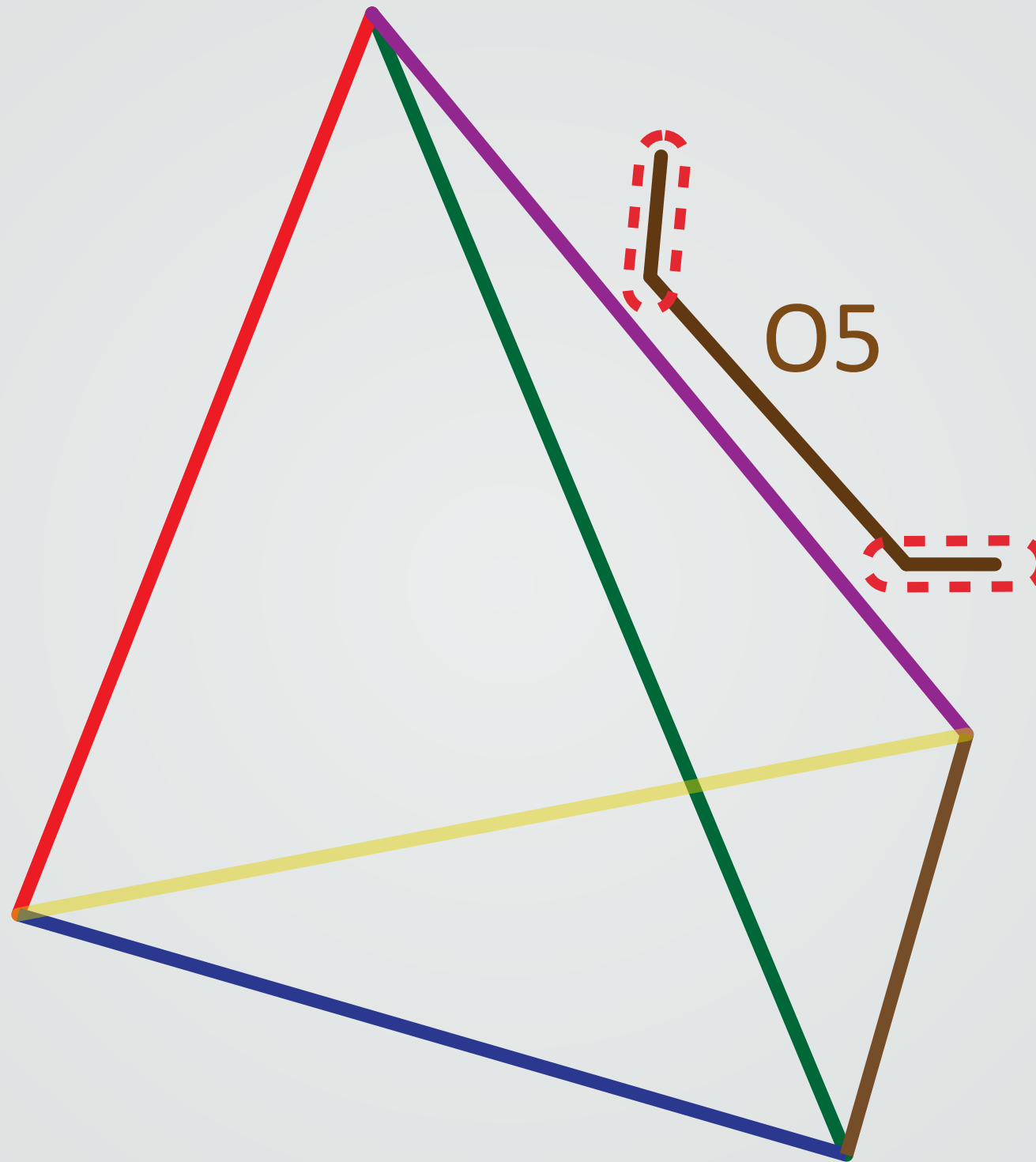
# The tetrahedron



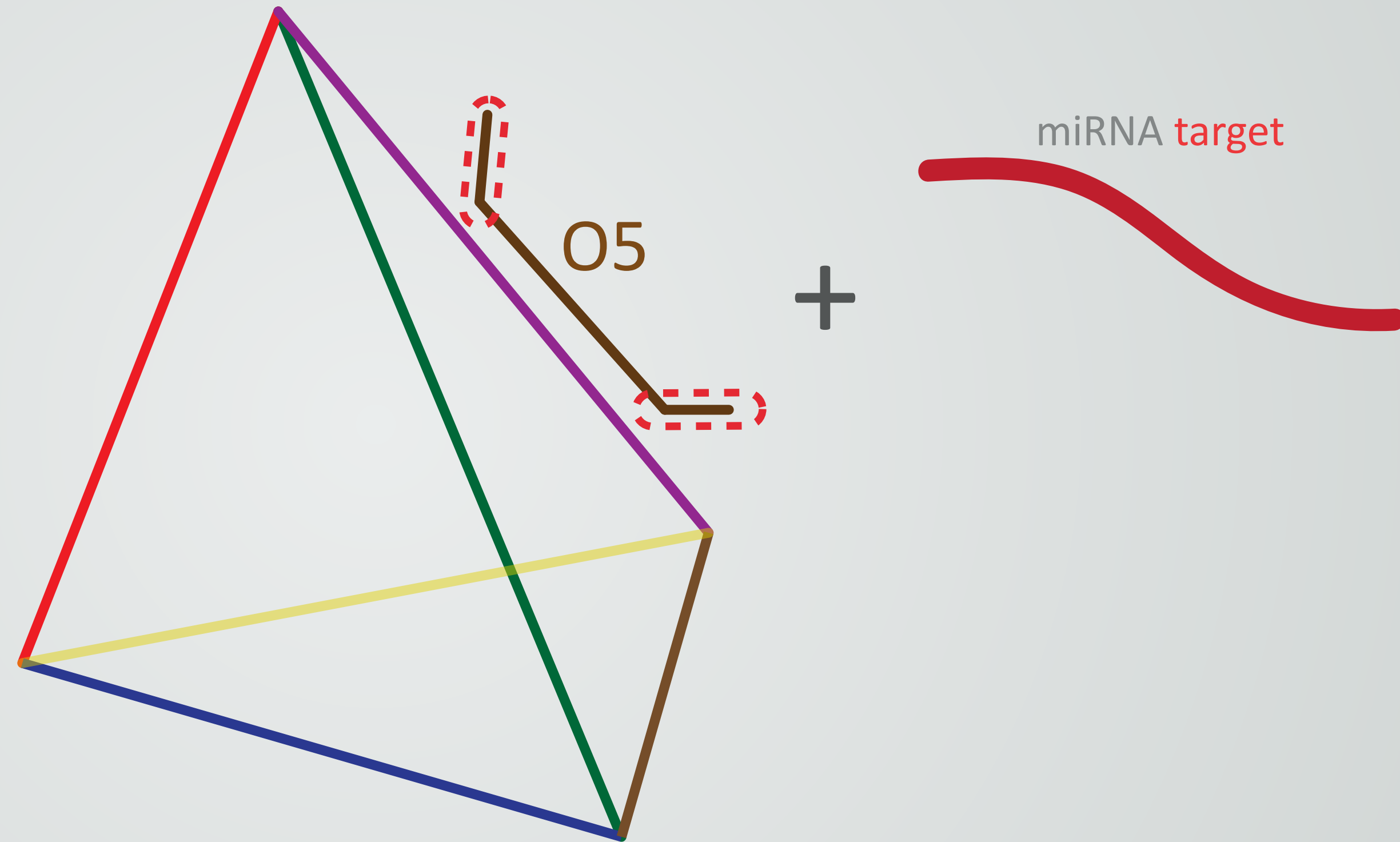
# The tetrahedron



# The tetrahedron

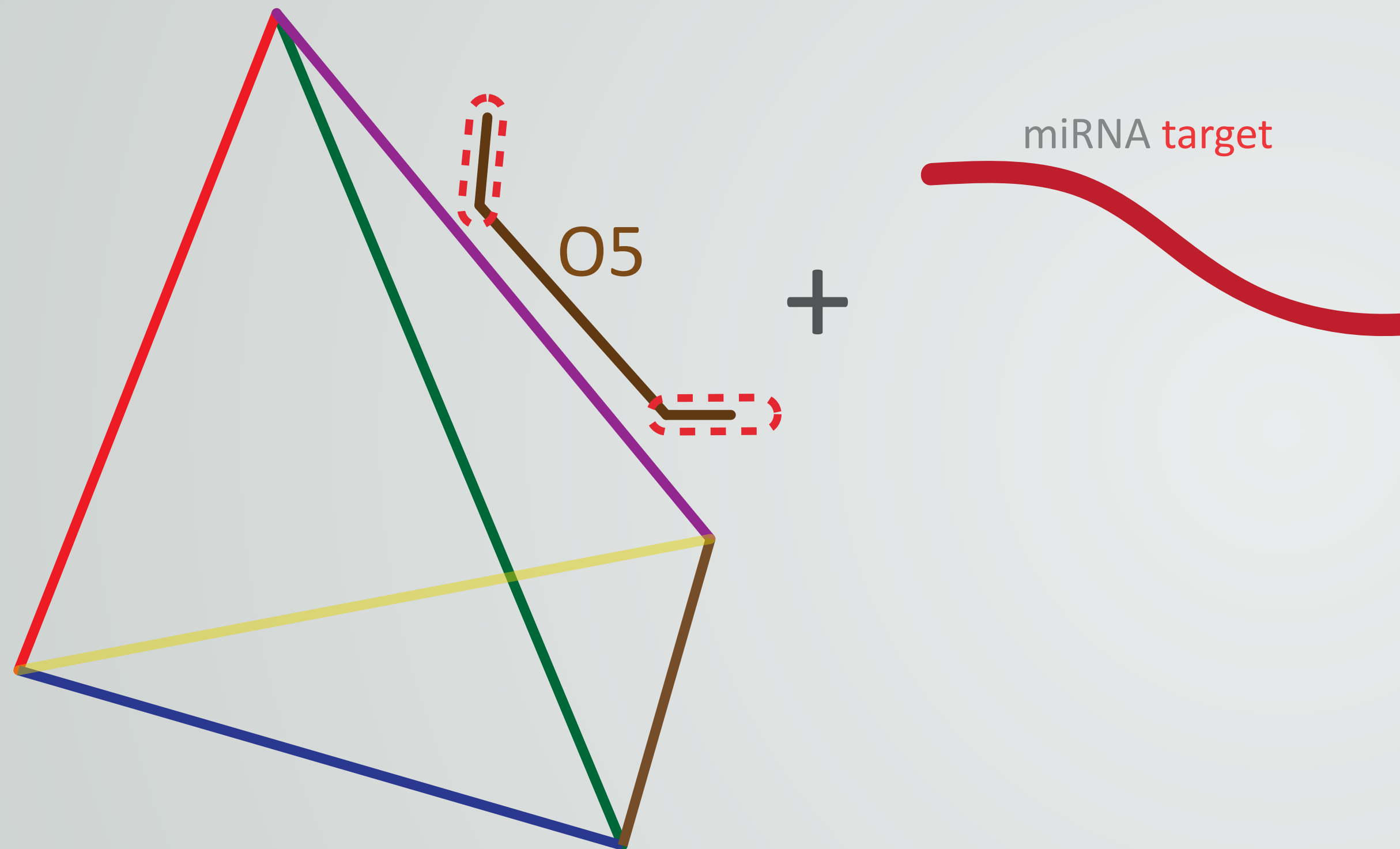


# The tetrahedron



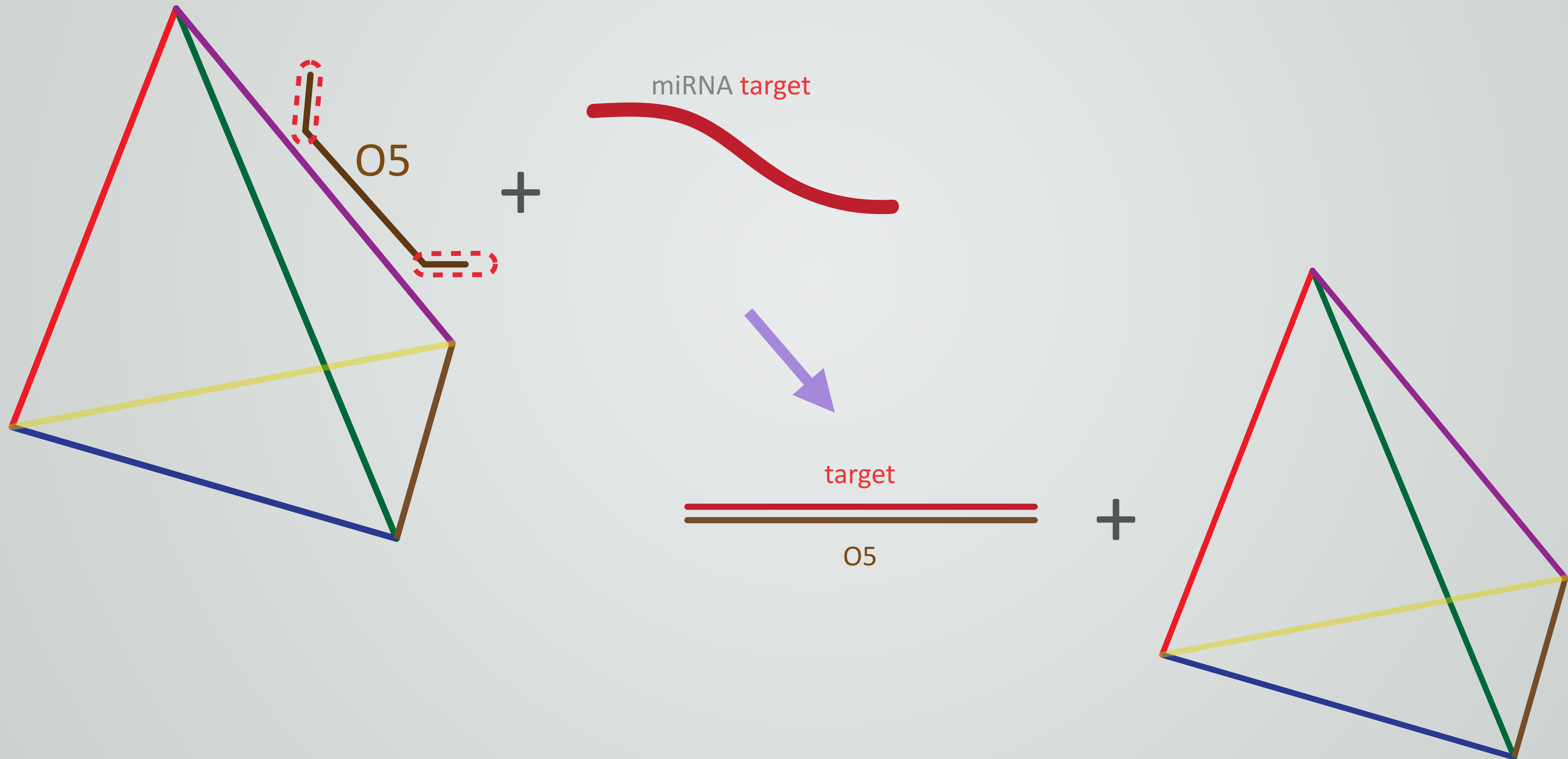


# The tetrahedron

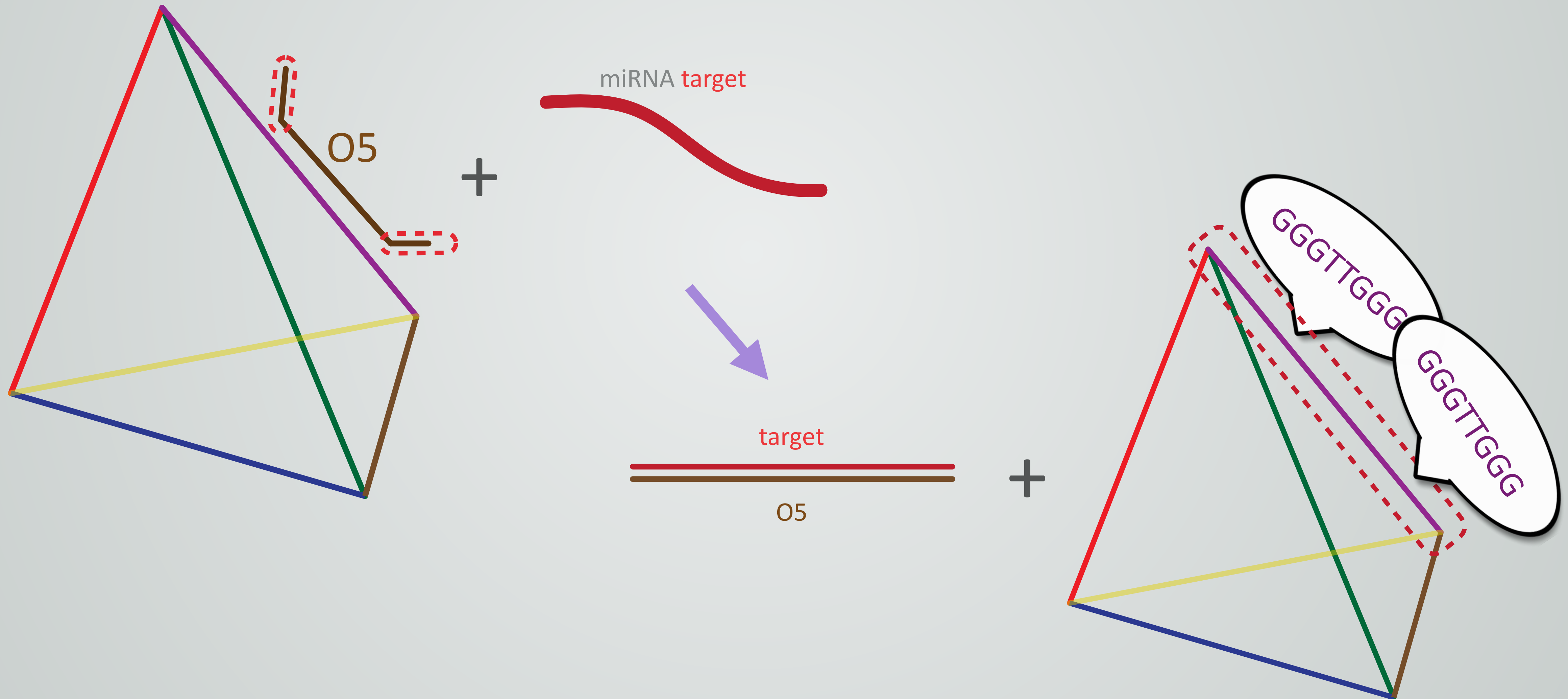




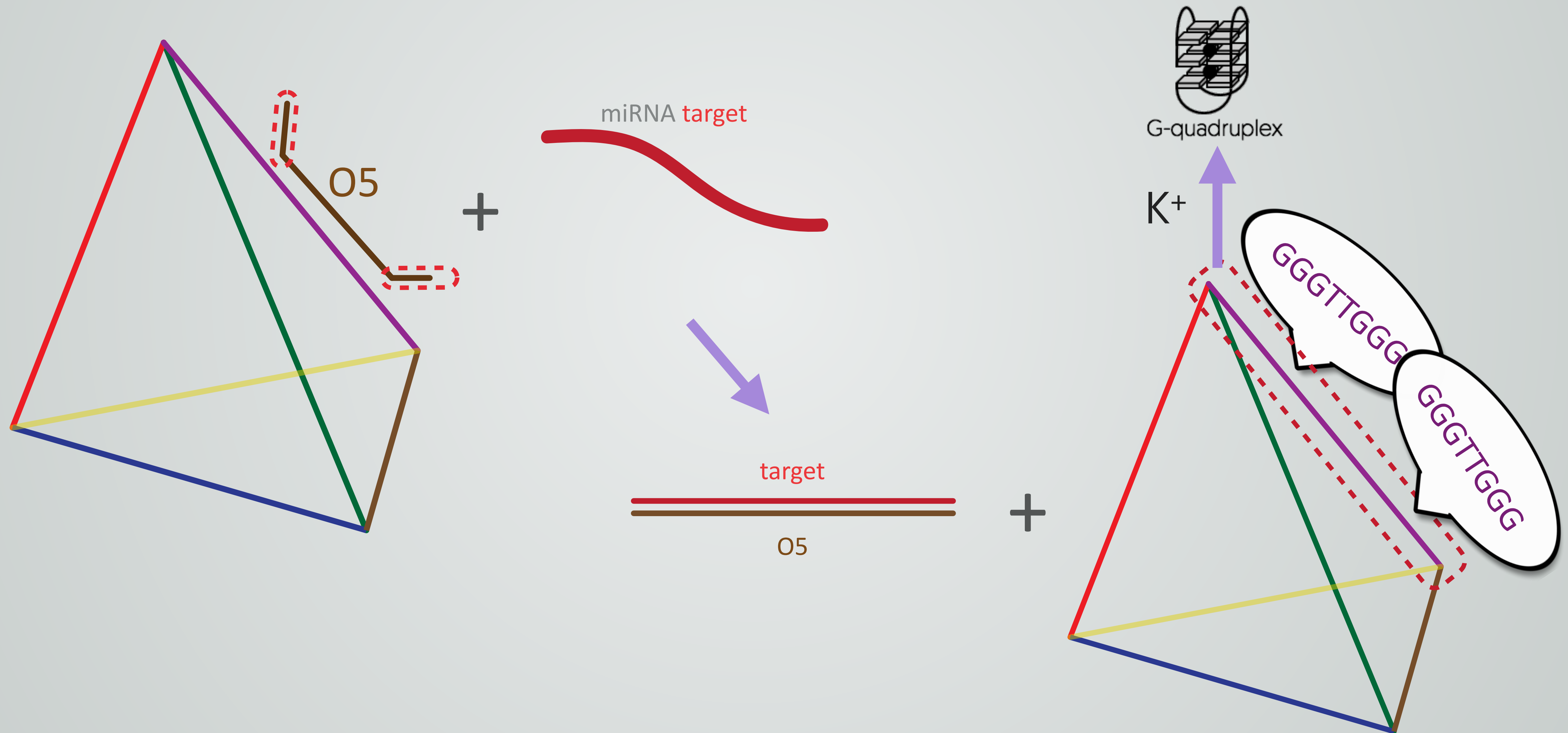
# The tetrahedron



# The tetrahedron

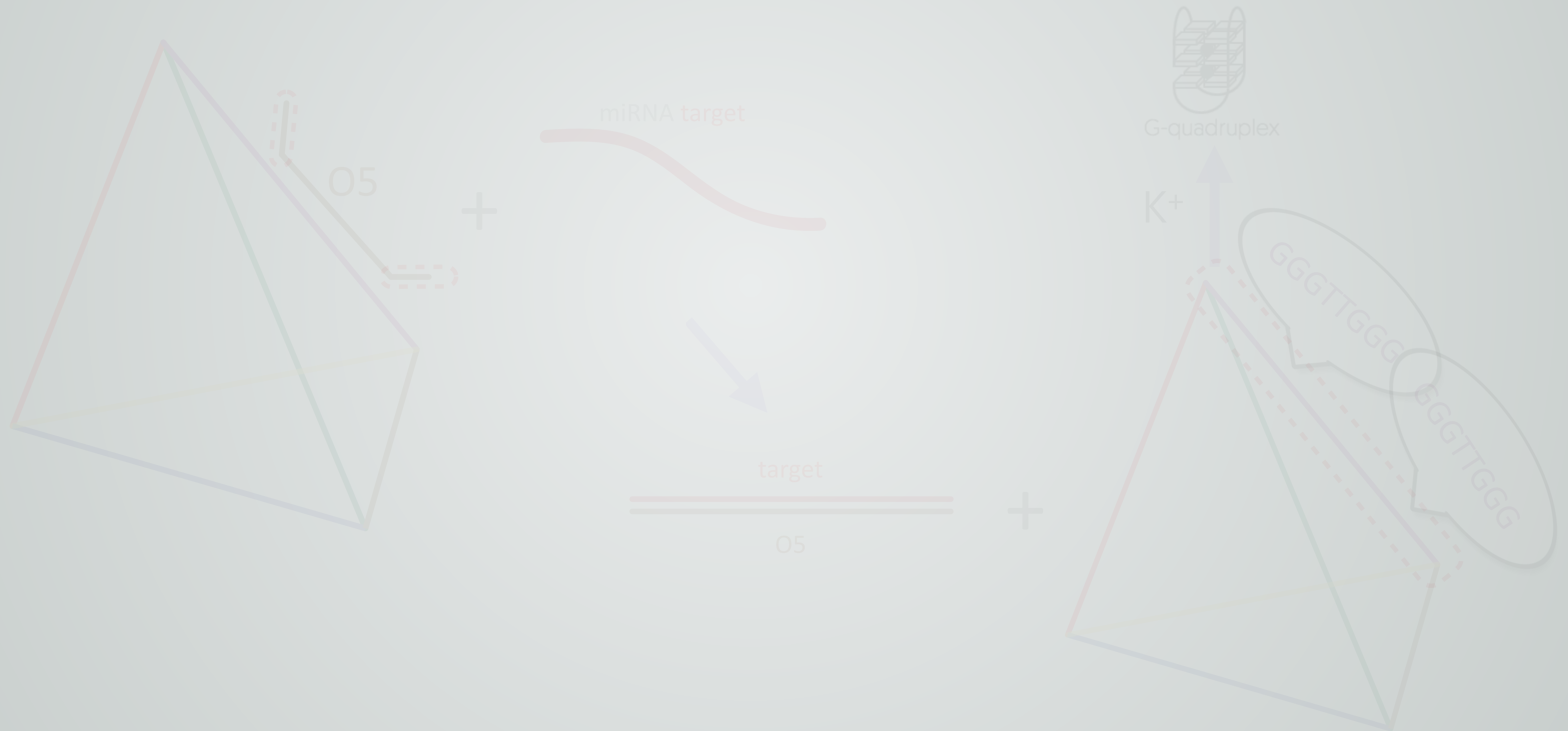


# The tetrahedron

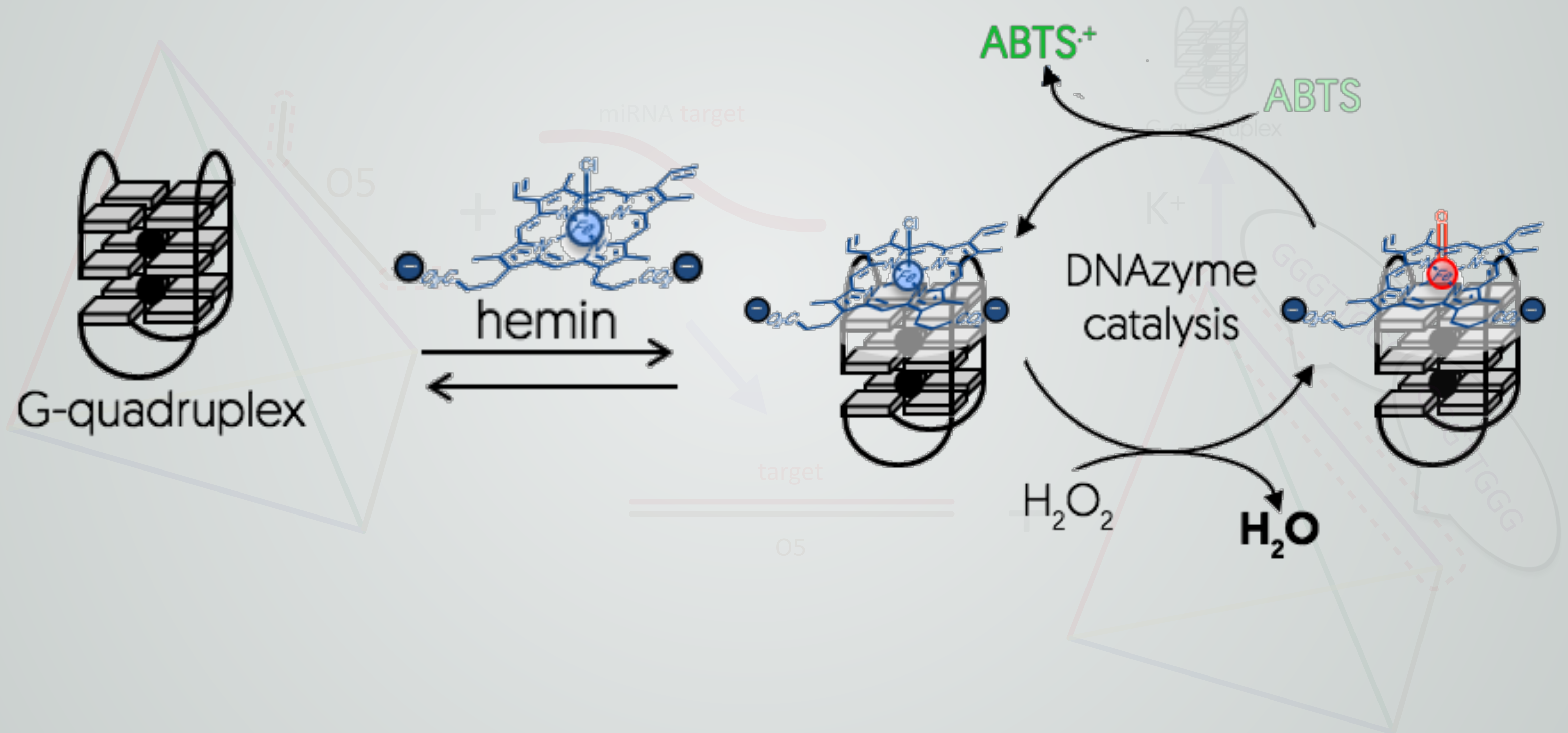




# The tetrahedron



# The tetrahedron







# The tetrahedron

# Our inspiration



# The tetrahedron



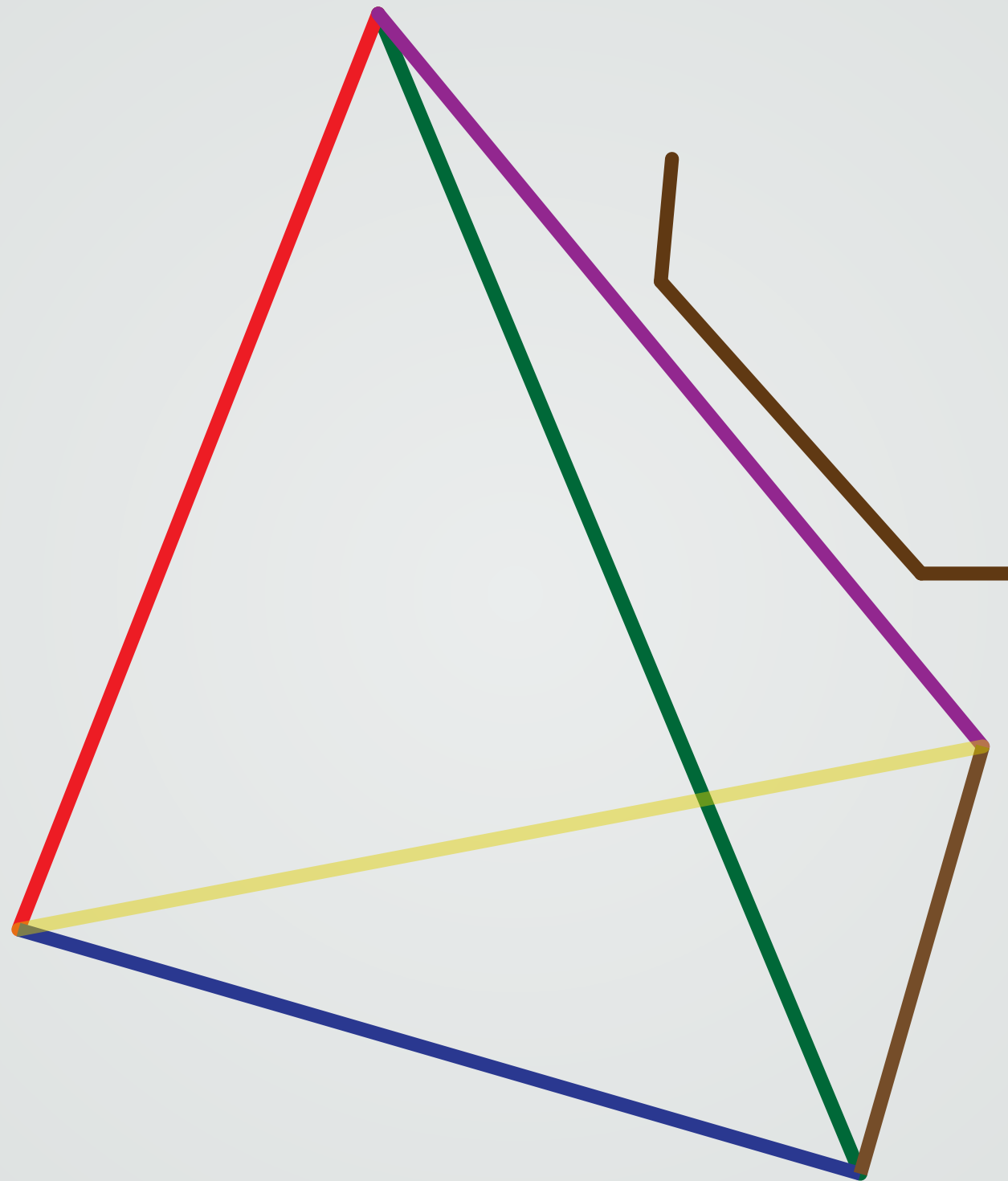


# The tetrahedron



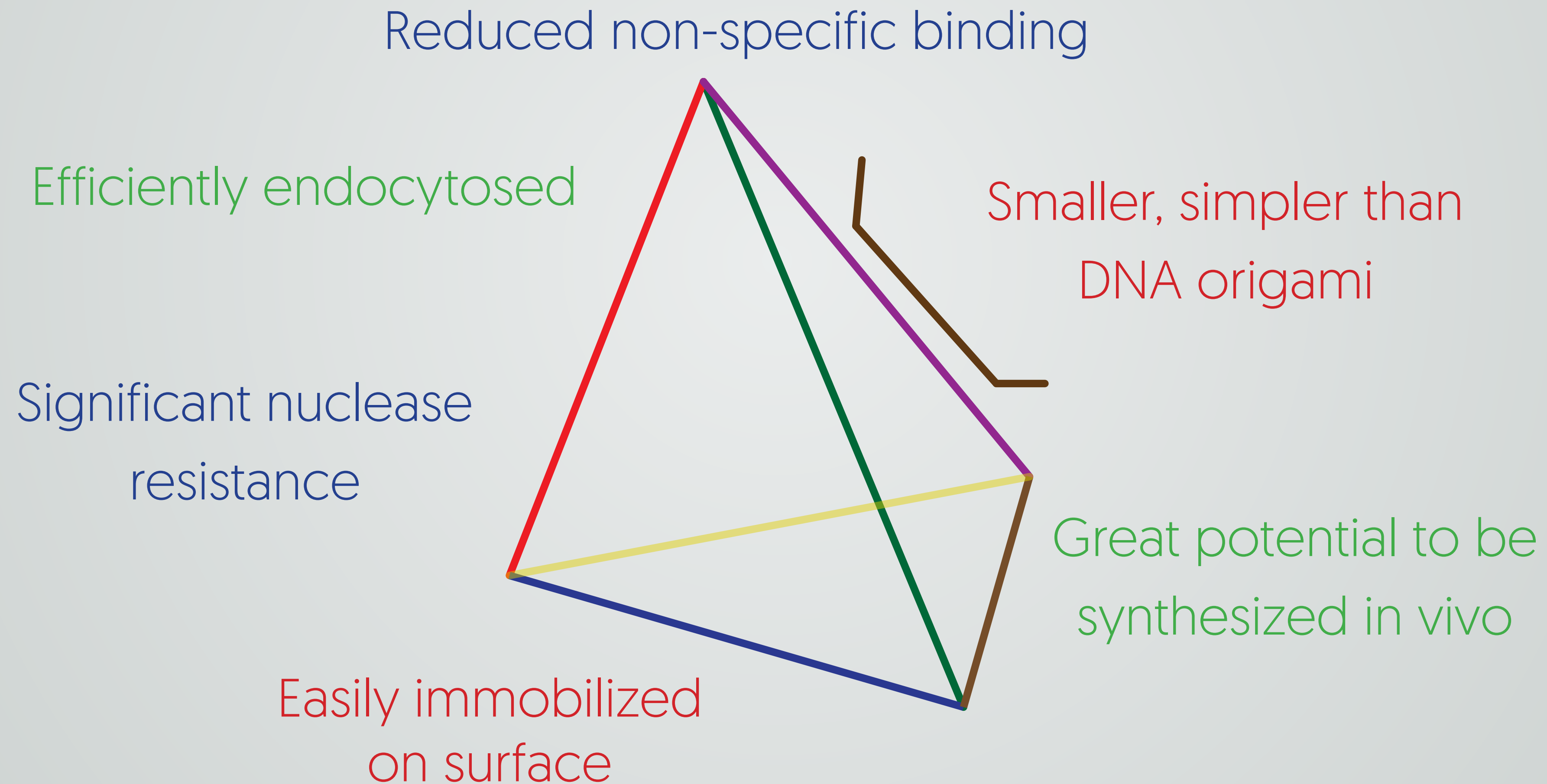
中國銀行  
BANK OF CHINA

# The tetrahedron



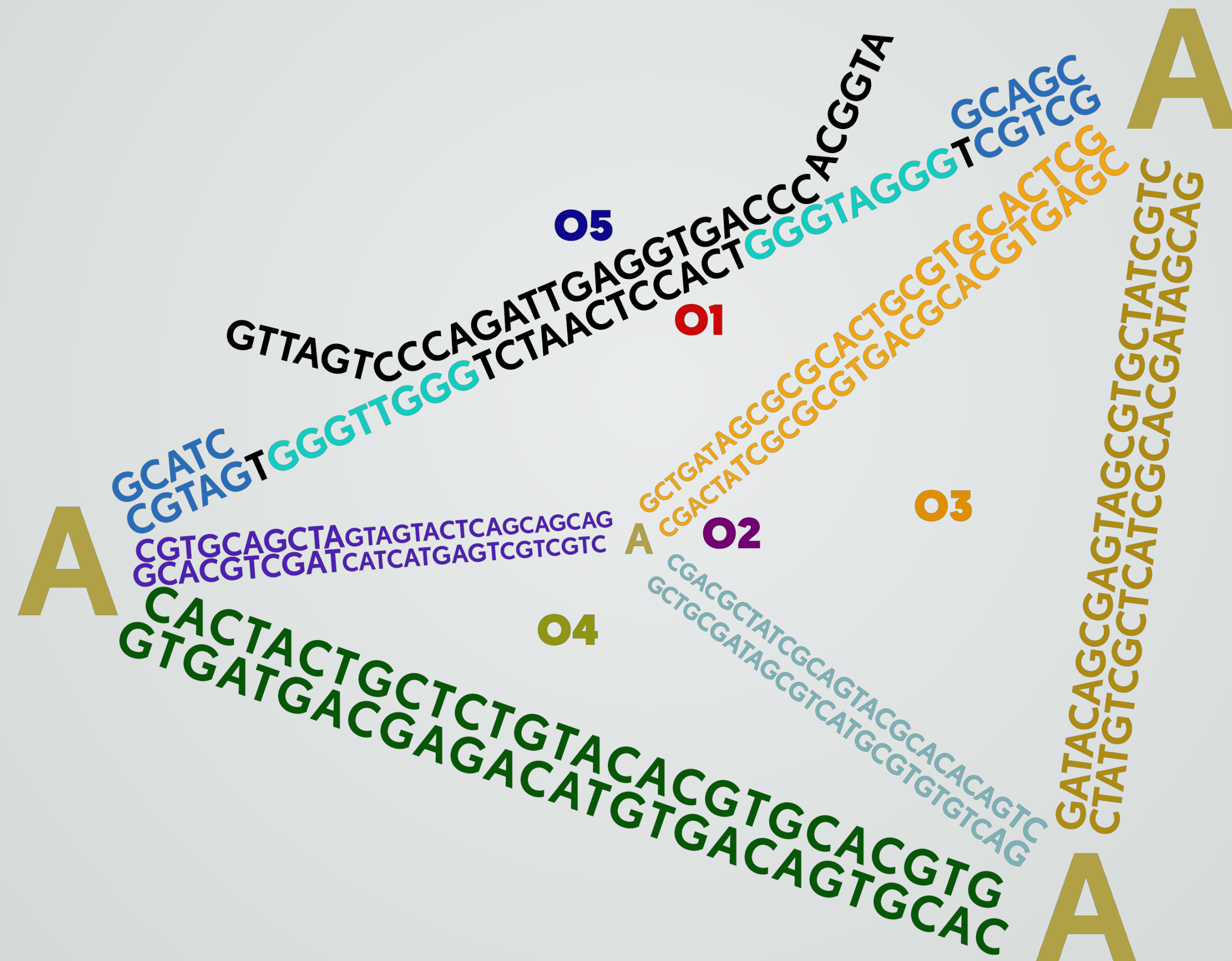


# The tetrahedron



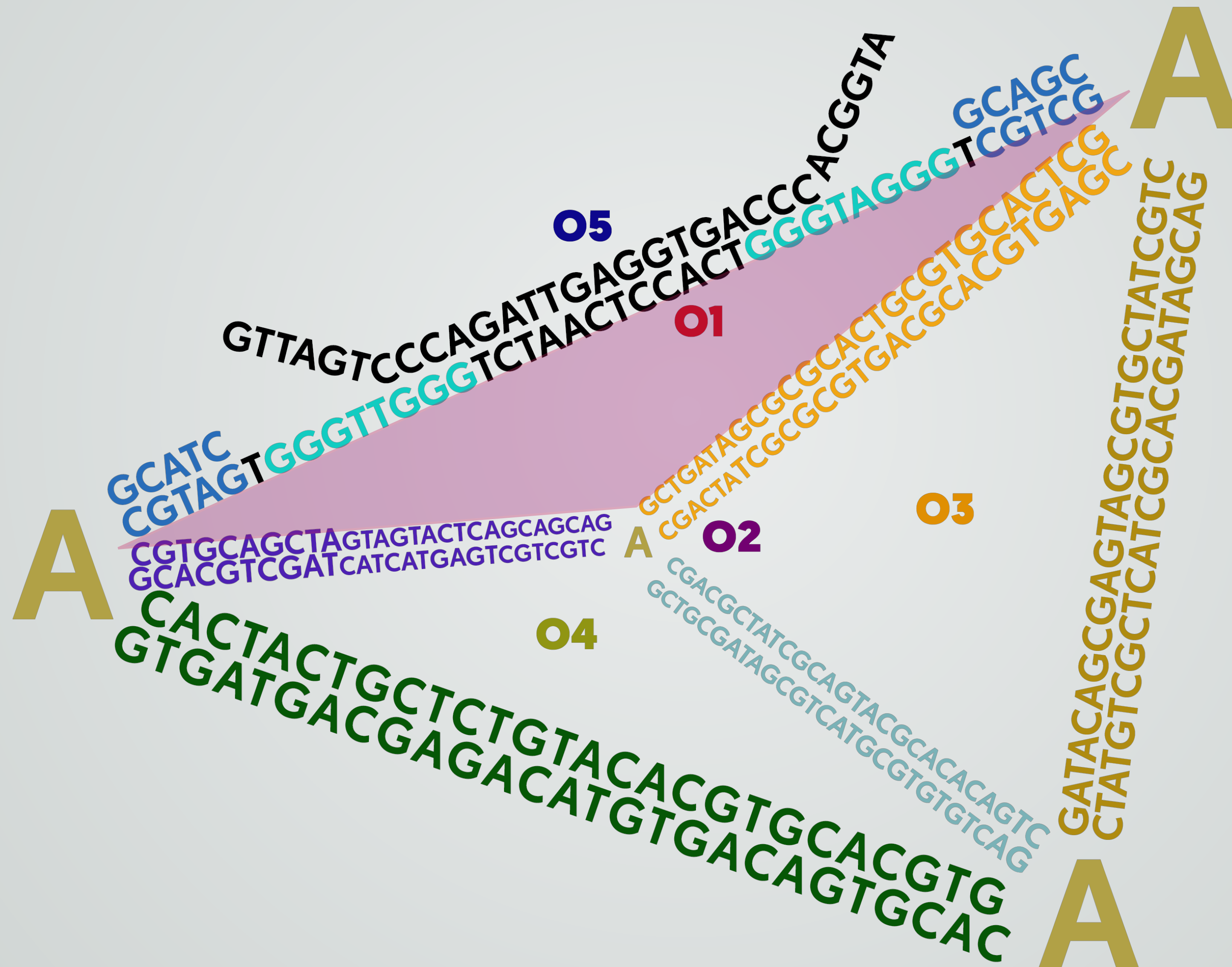


# The tetrahedron



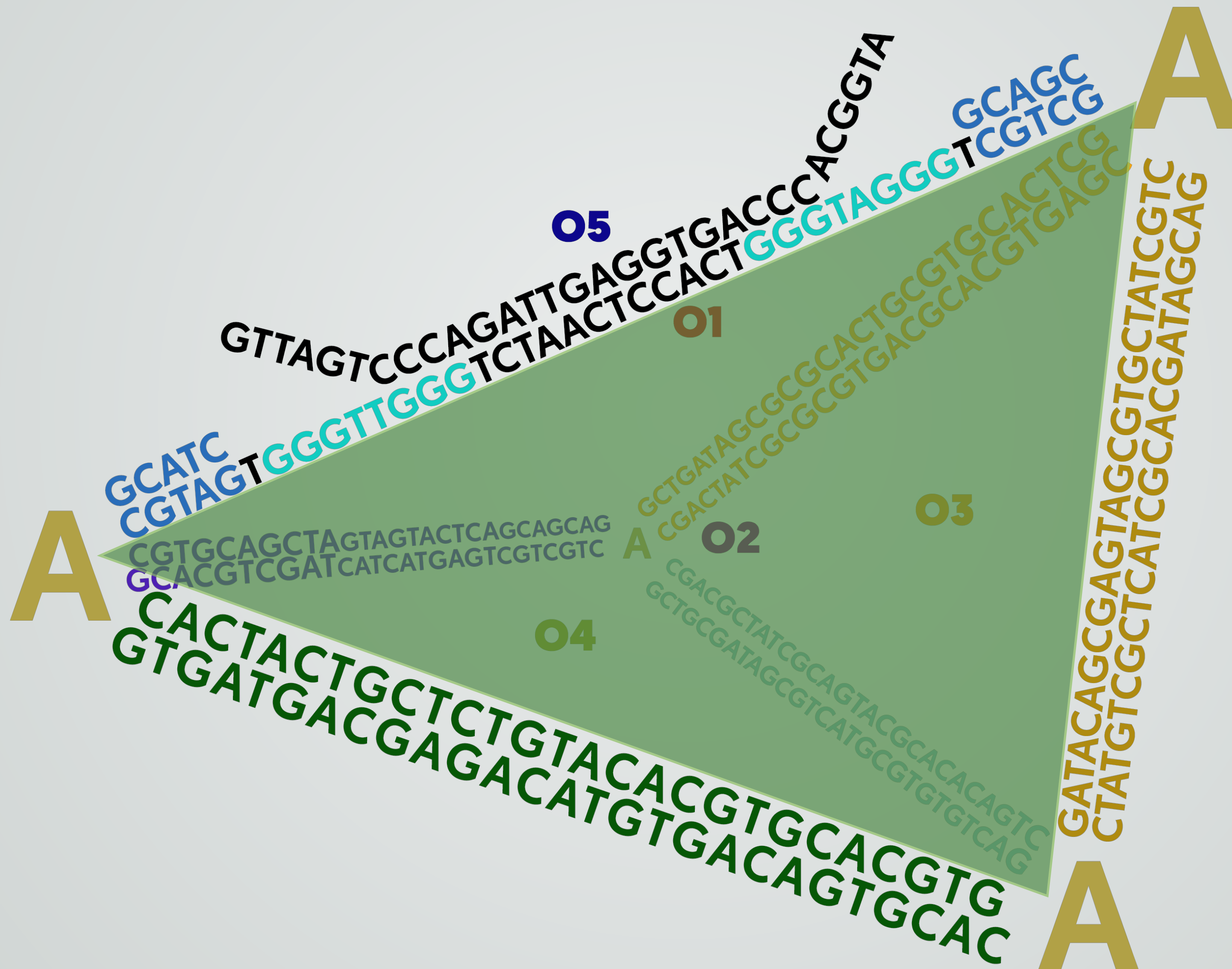
# Results

# Results

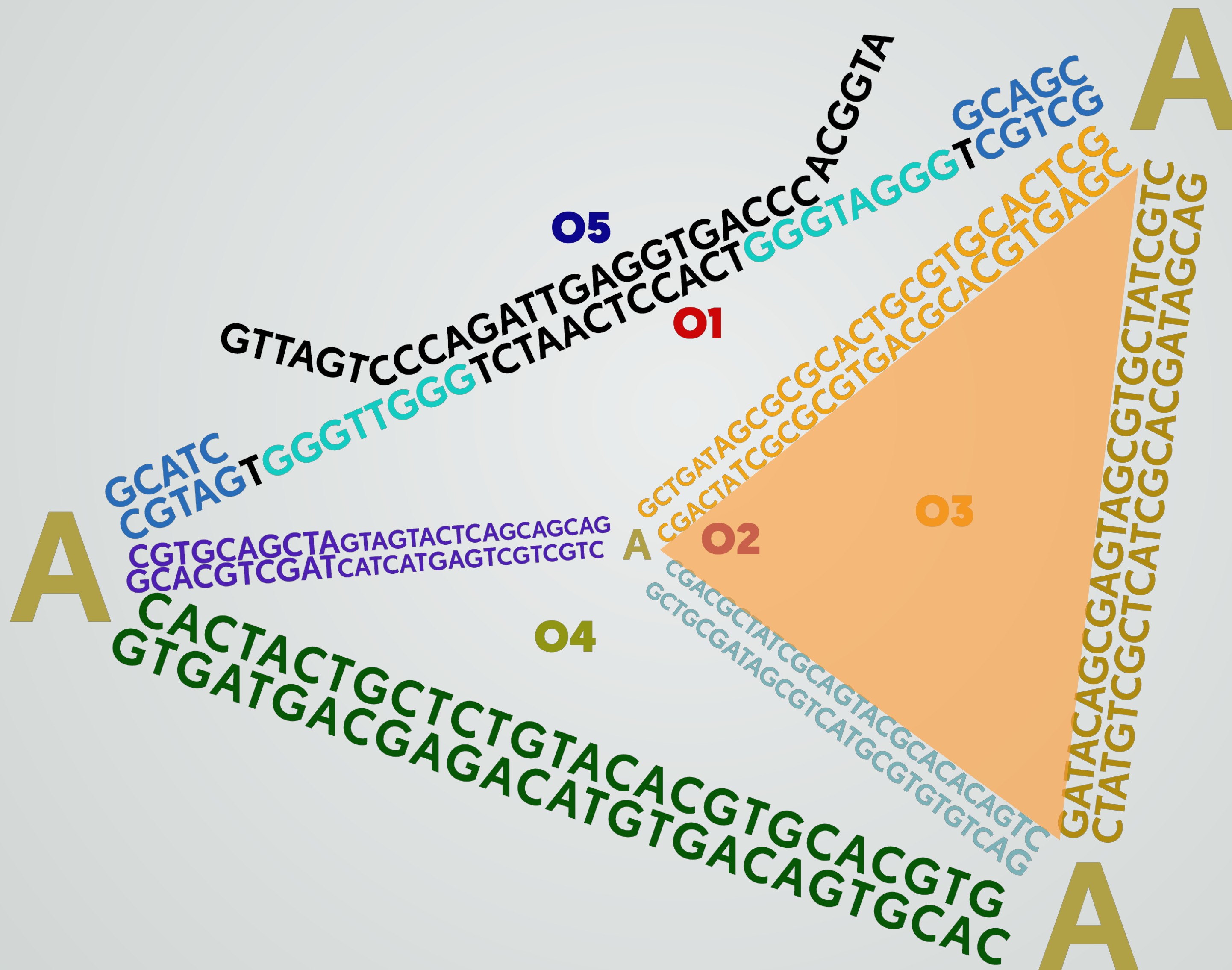




# Results

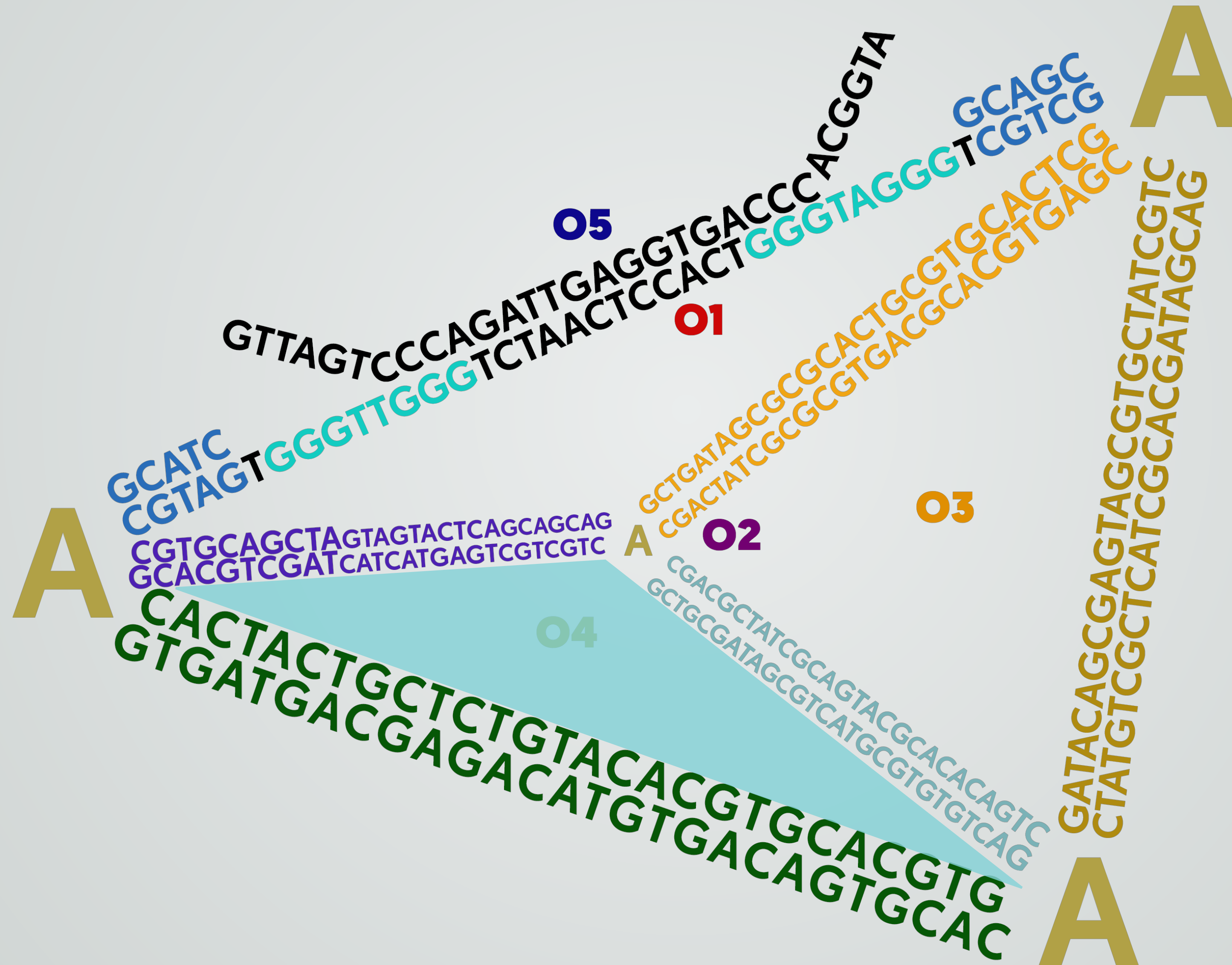


# Results

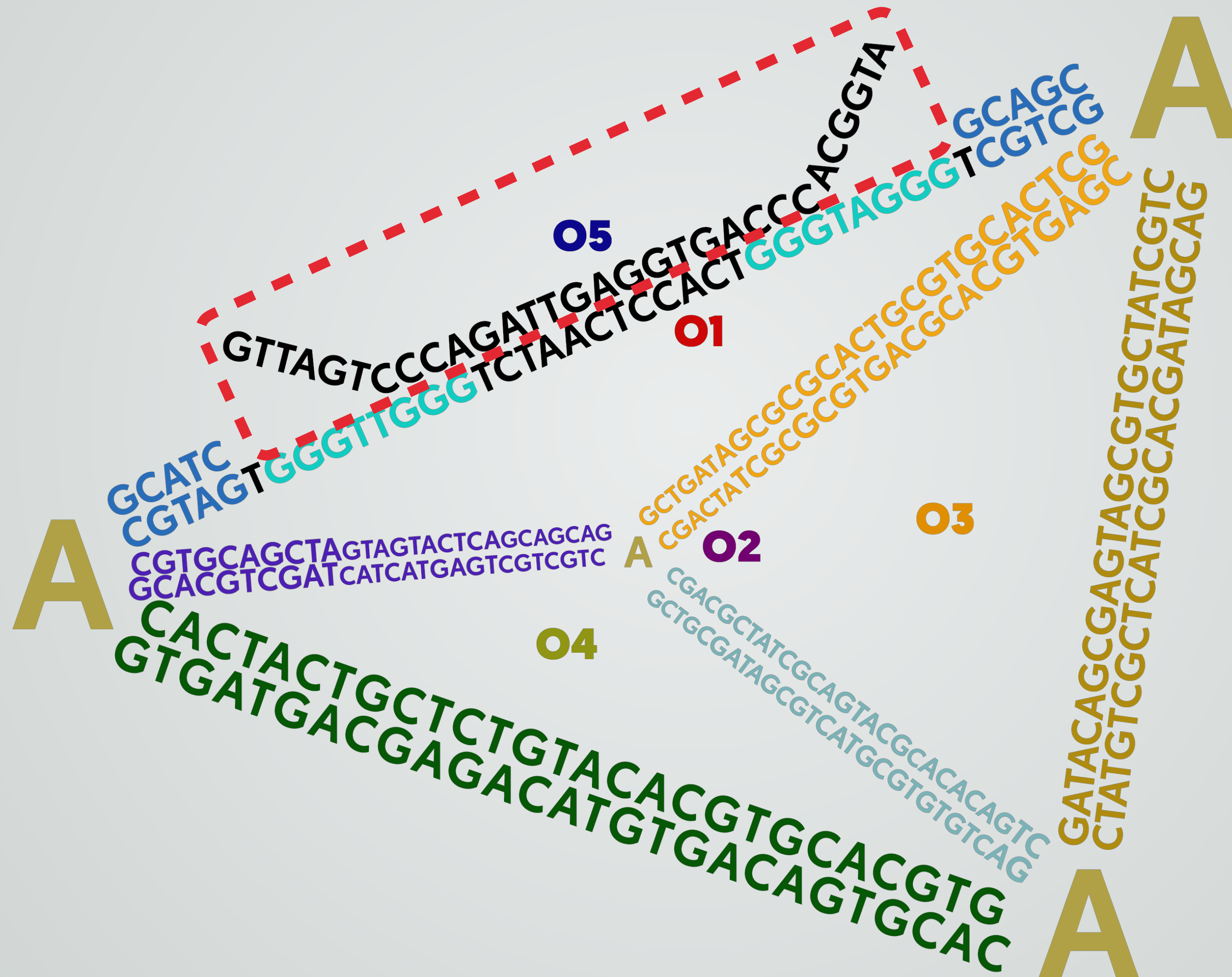




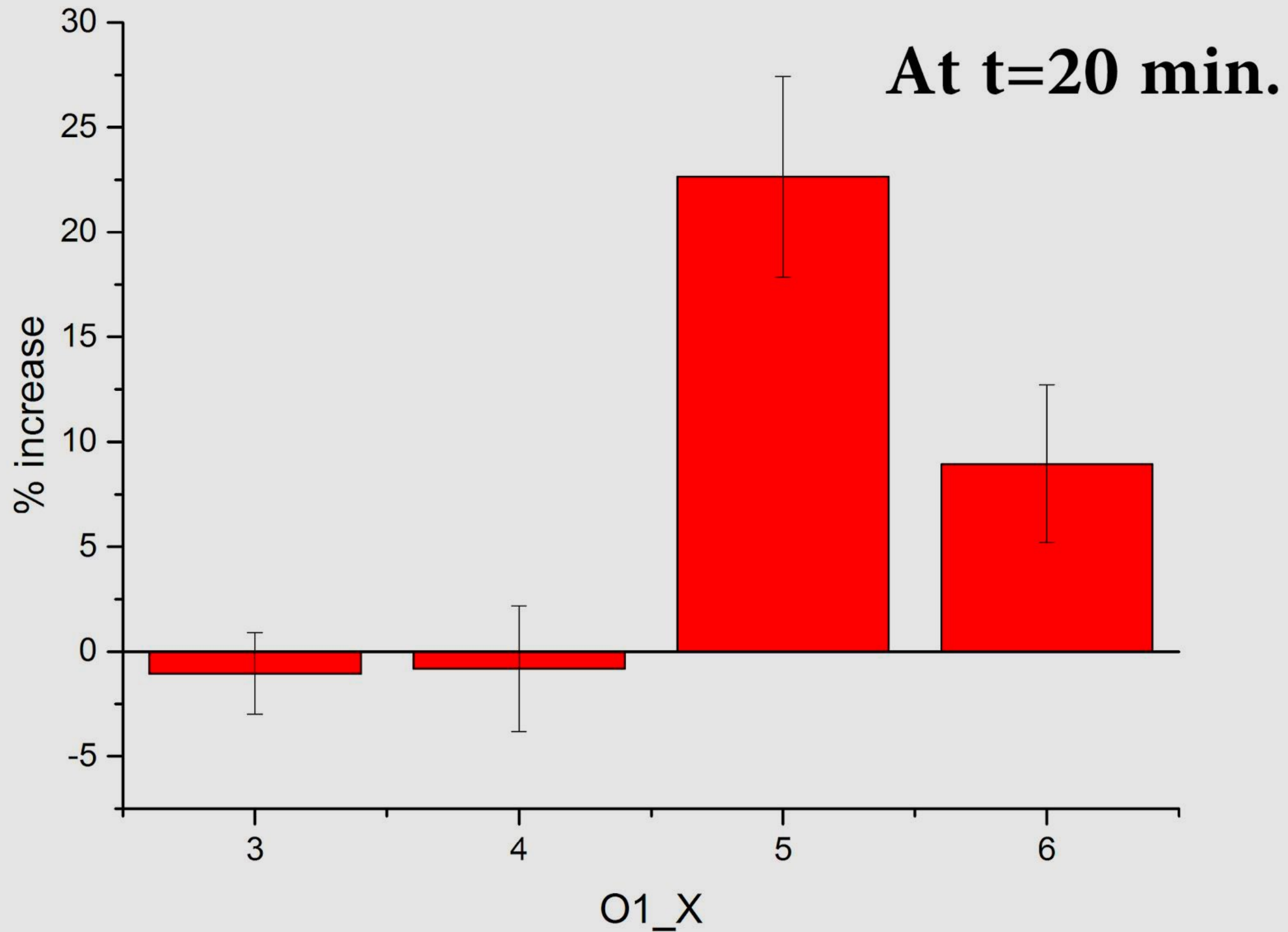
# Results



# Results



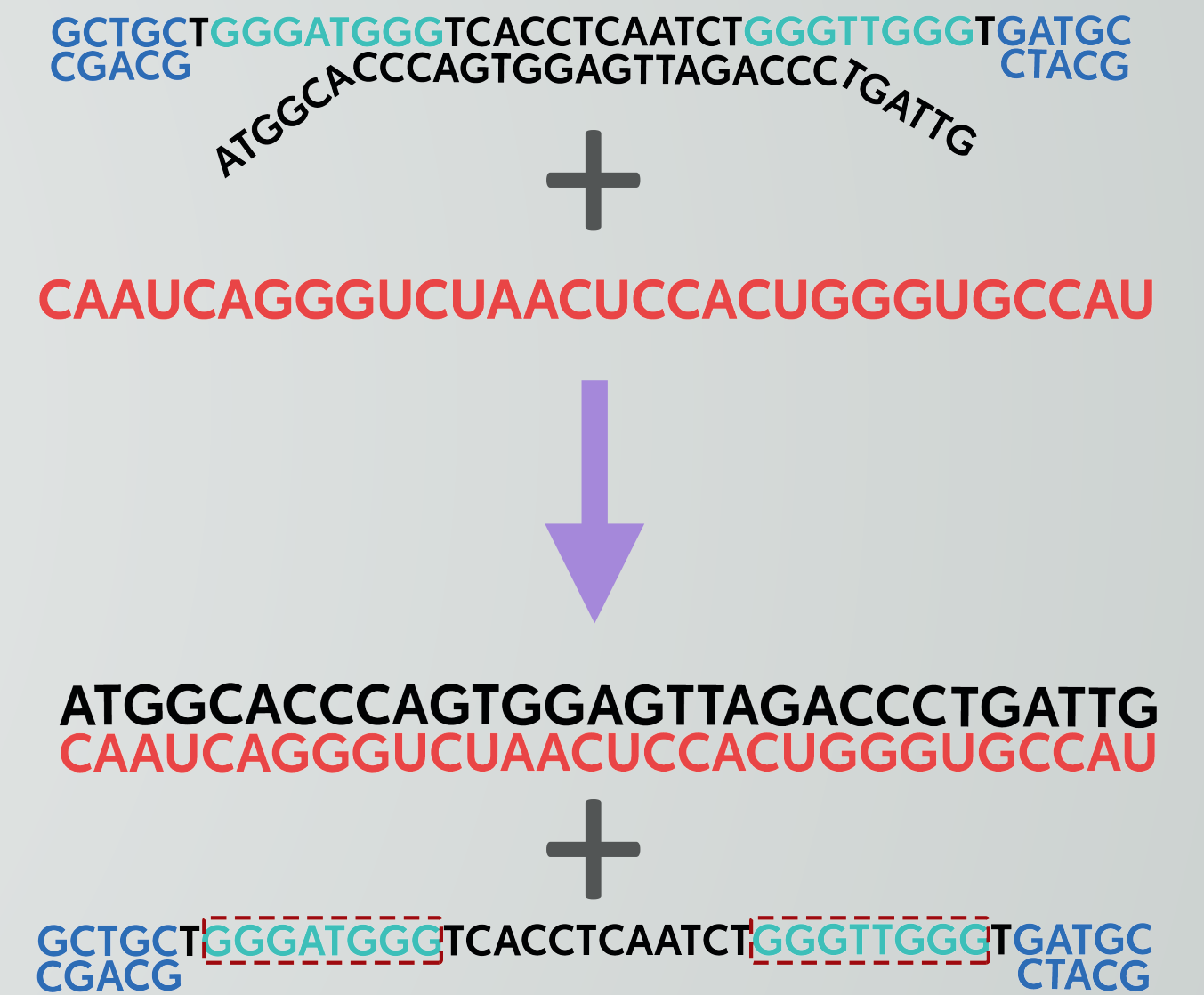
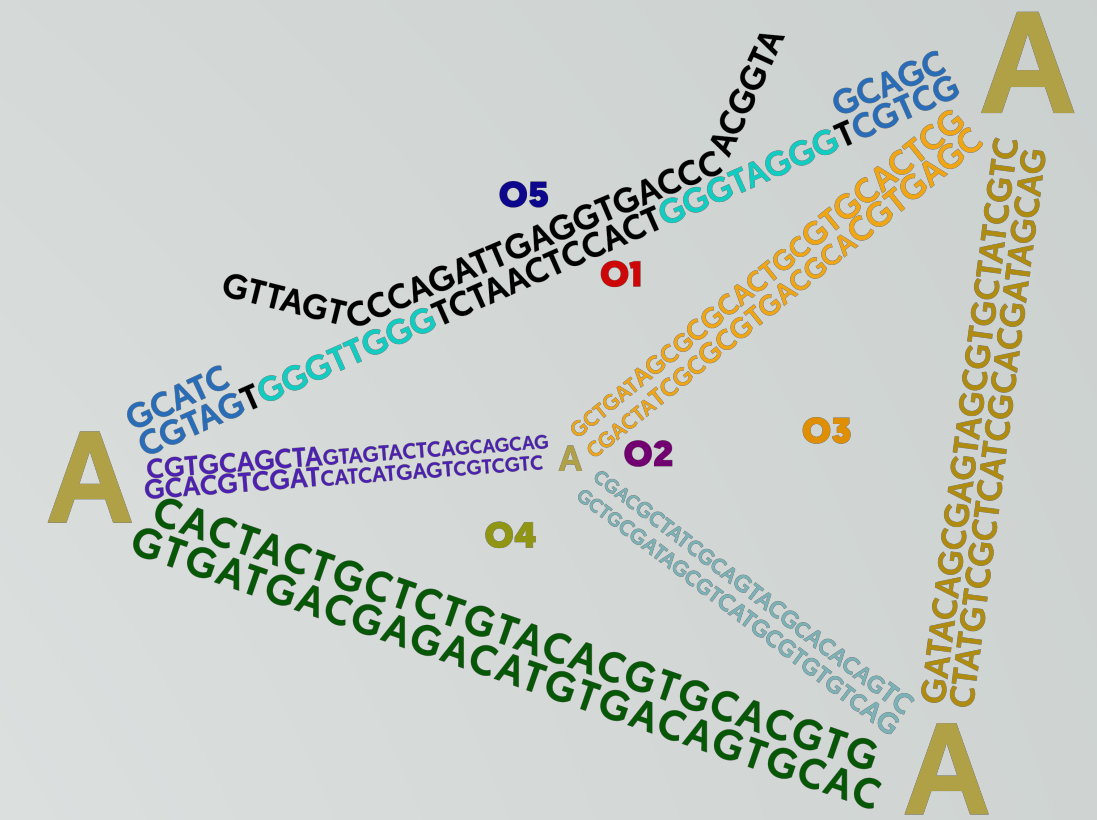
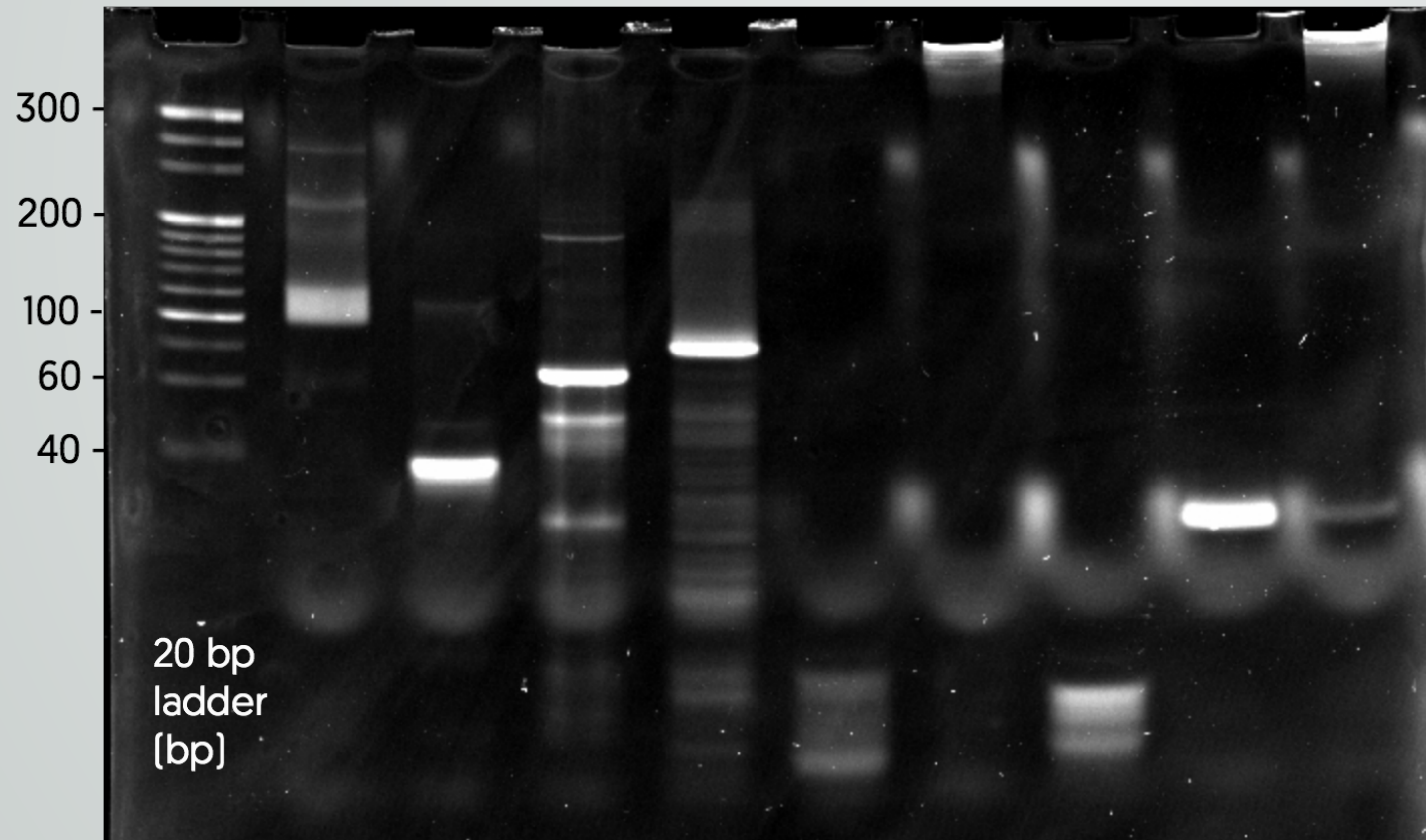
# Results





# Results

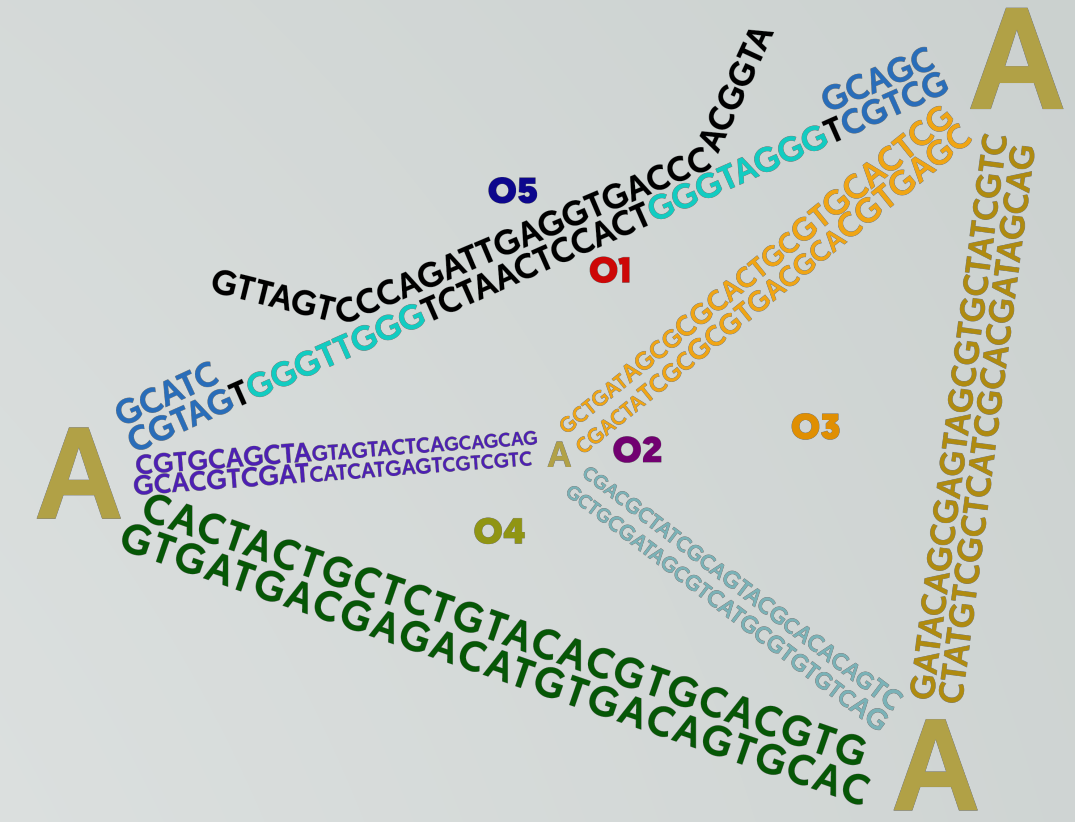
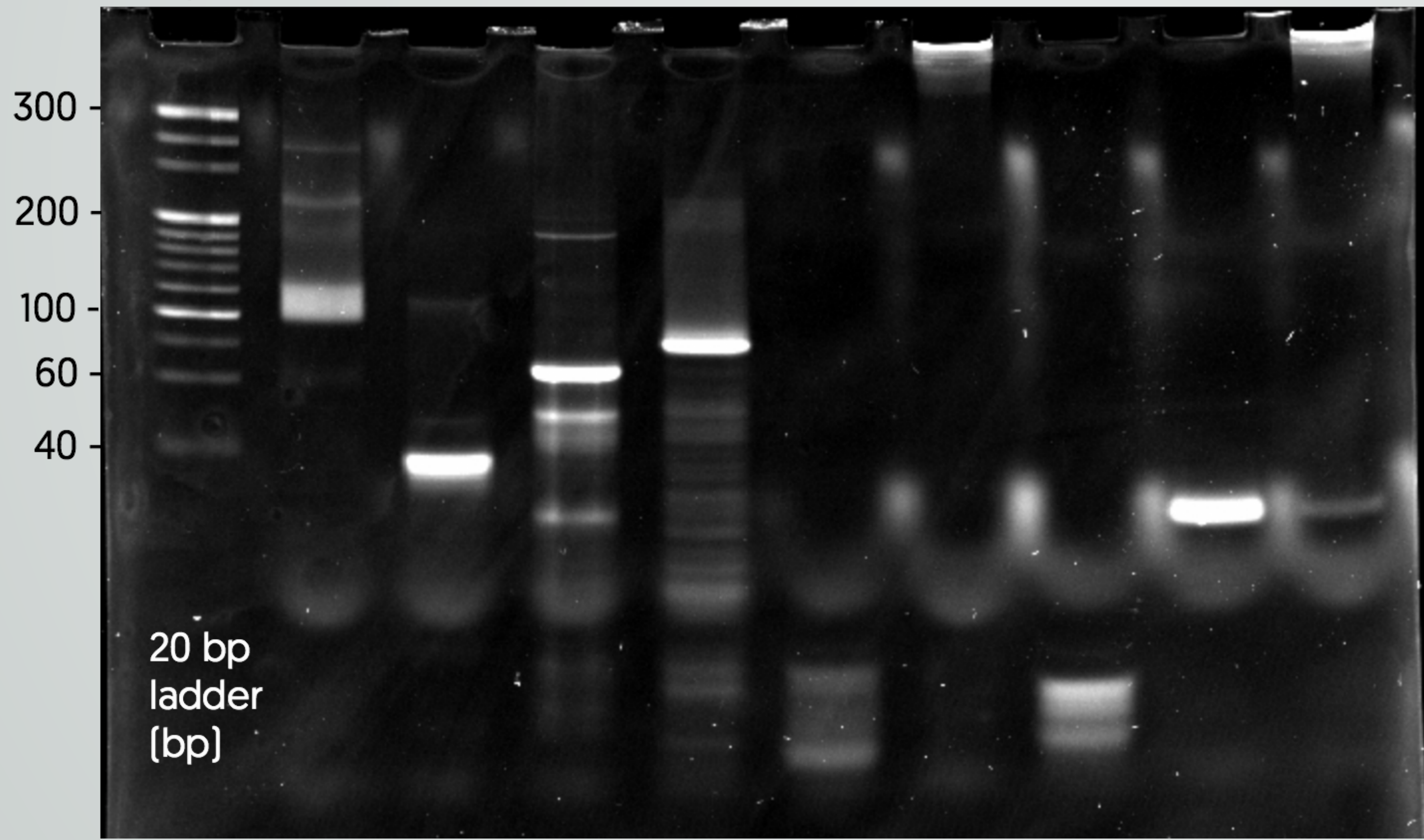
O1	+					+				+
O2		+				+				+
O3			+			+				+
O4				+		+				+
O5					+	+		+	+	+
input							+	+		+





# Results

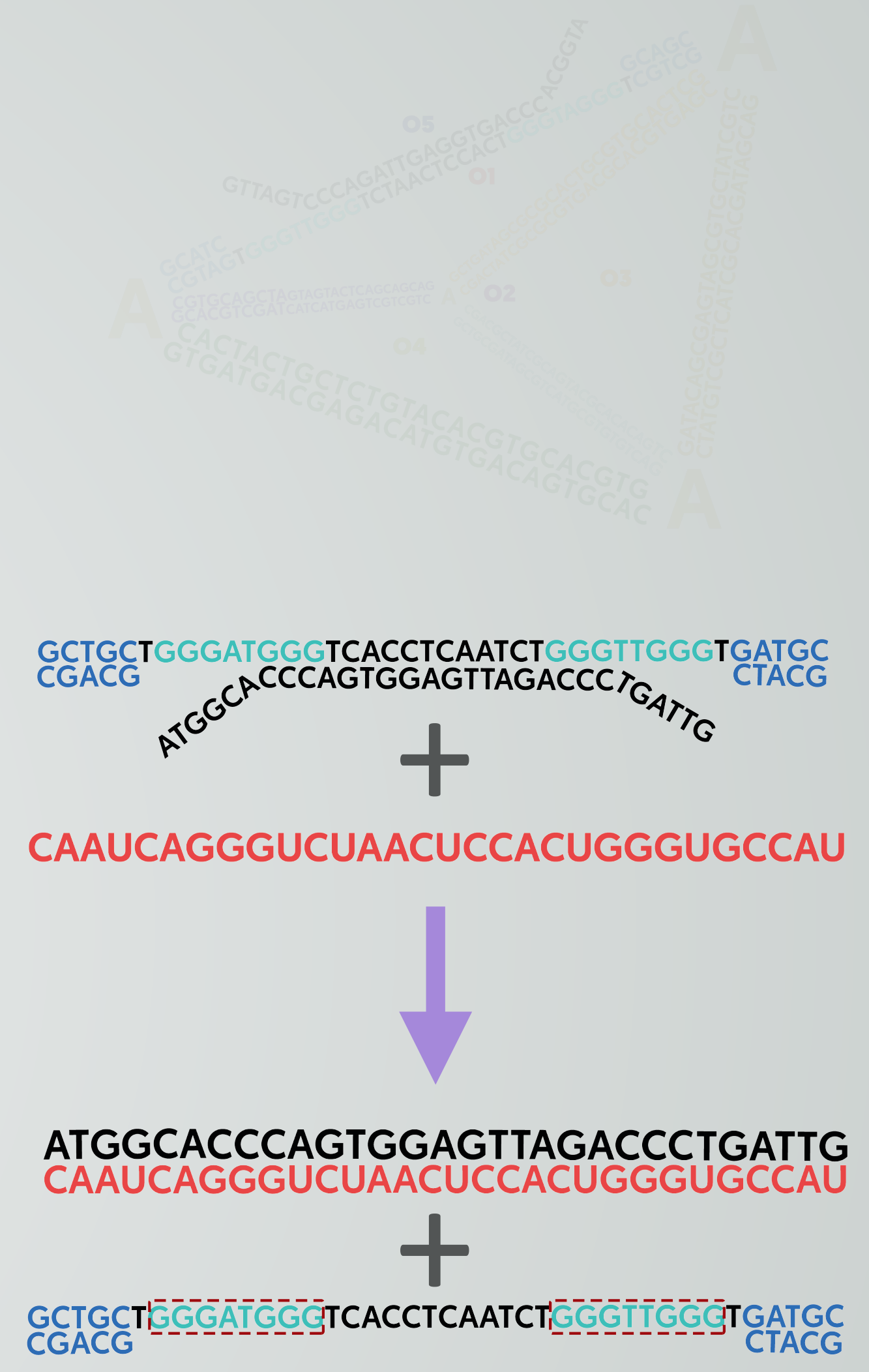
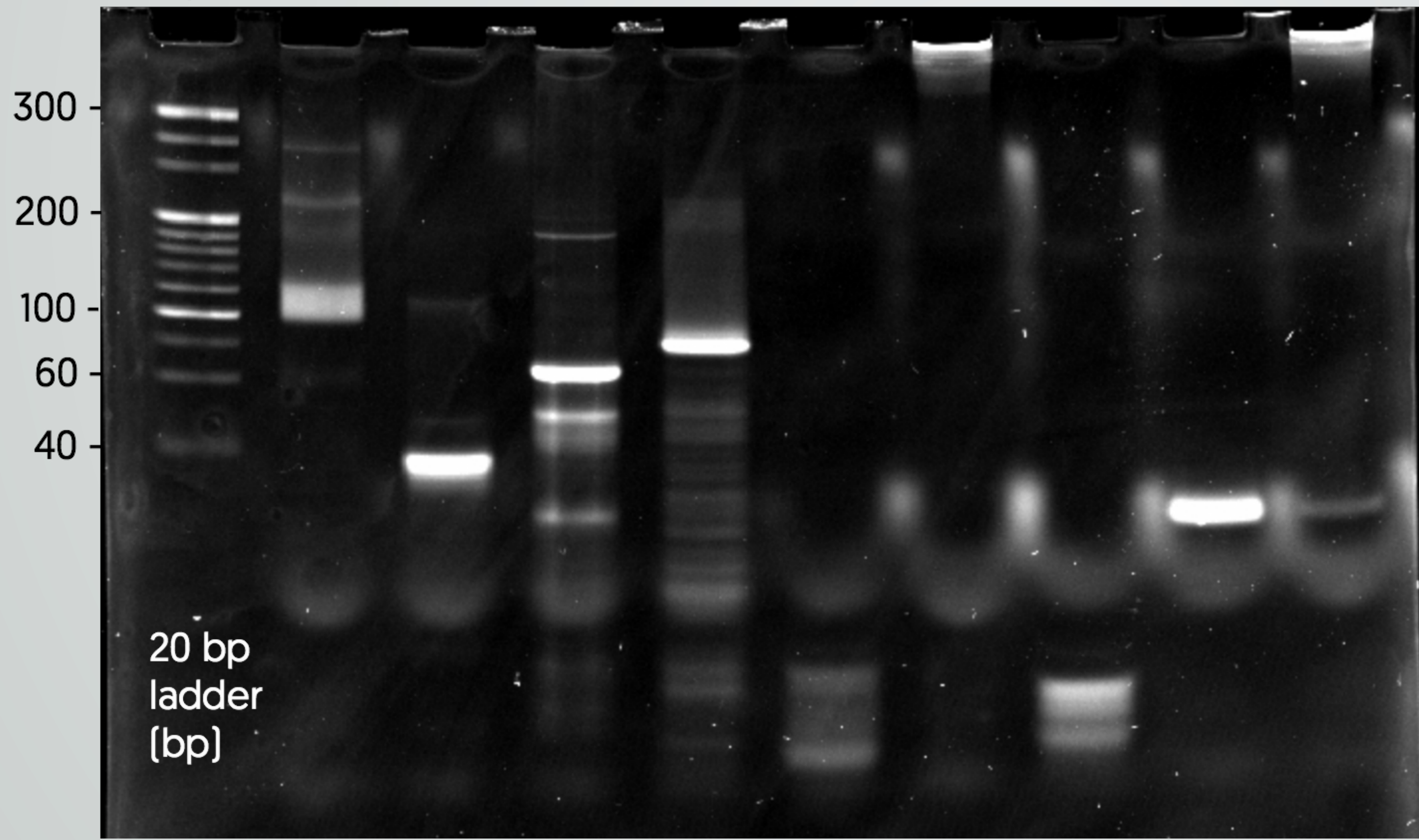
O1	+					+				+
O2		+				+				+
O3			+			+				+
O4				+		+				+
O5					+	+		+		+
input							+	+		+

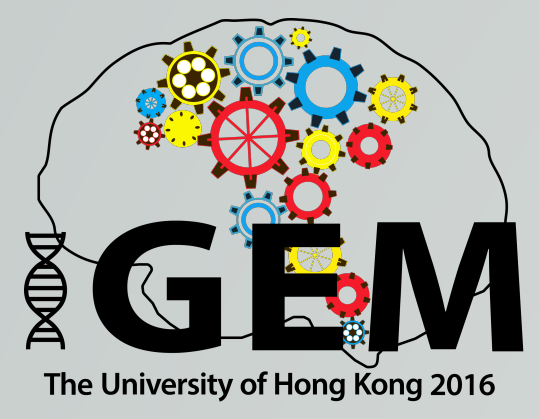




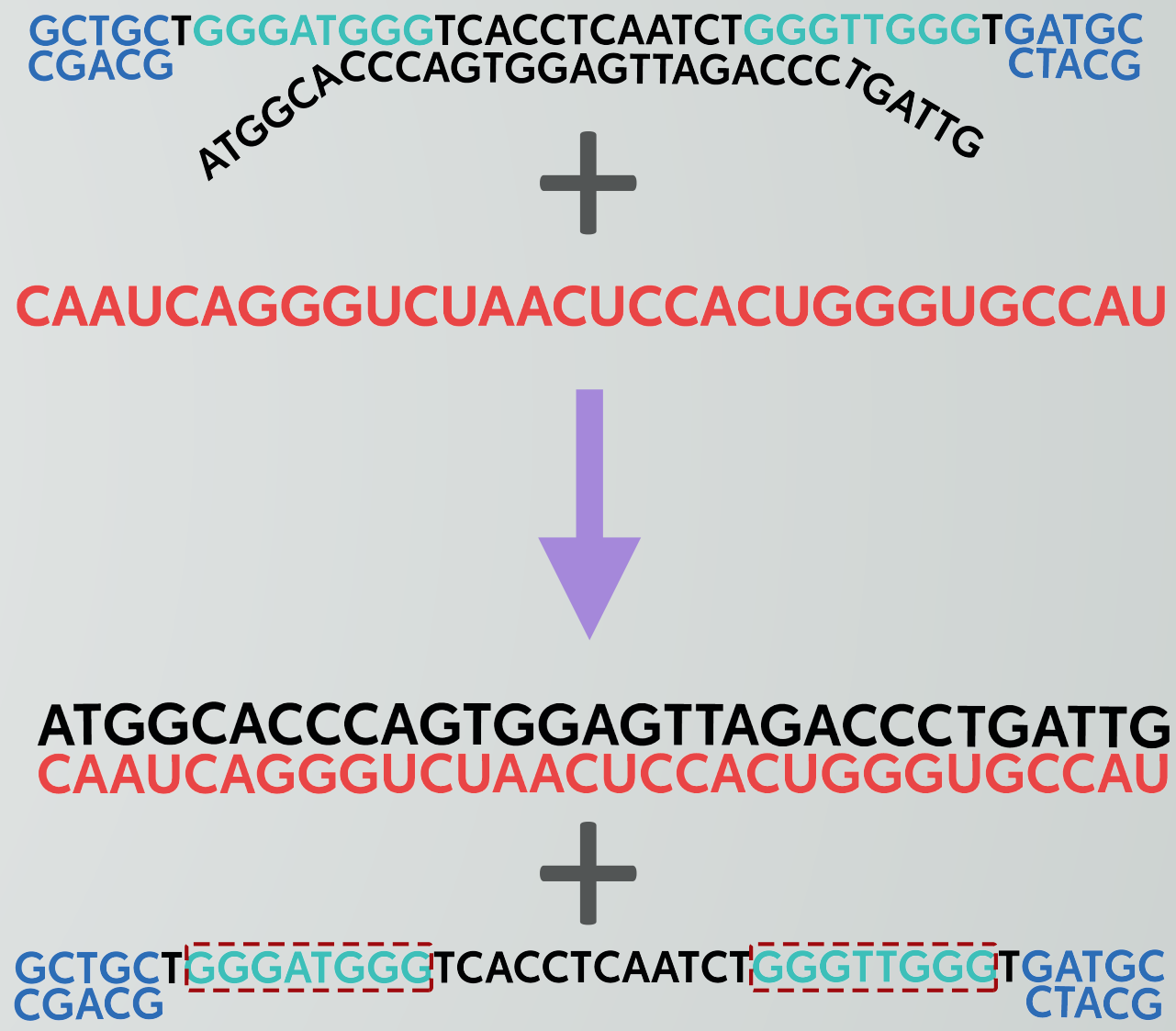
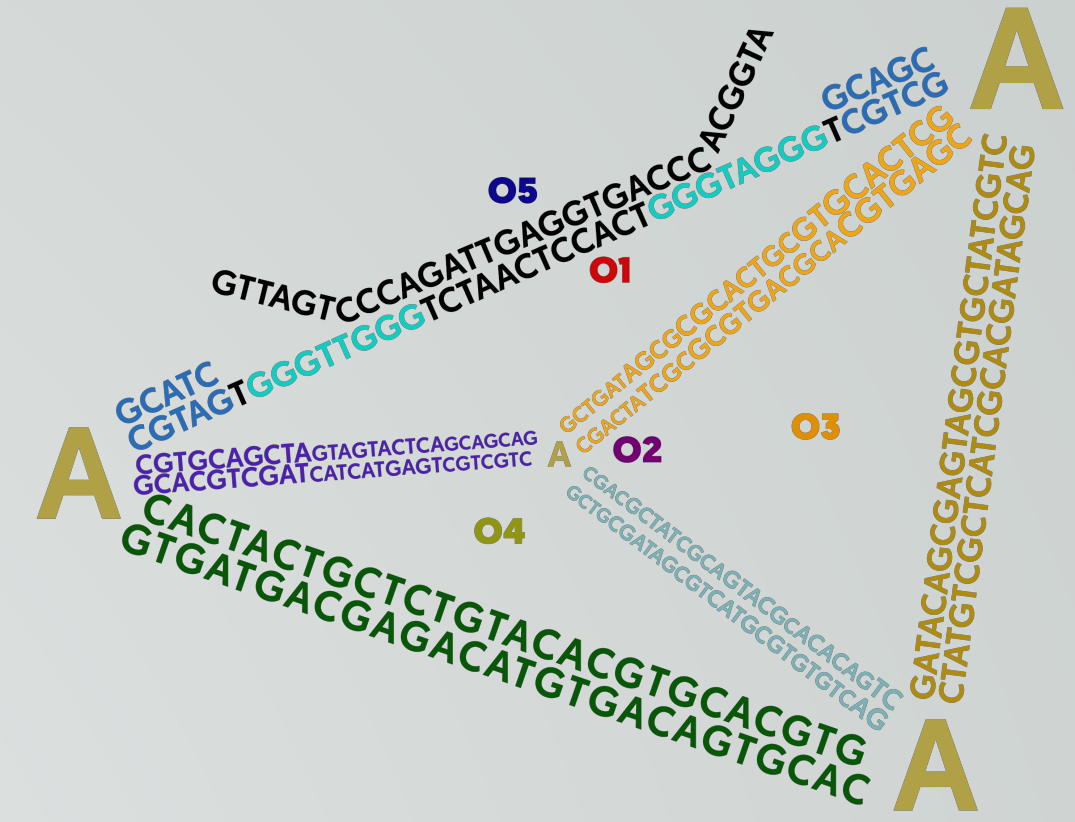
# Results

O1	+					+			+
O2		+				+			+
O3			+			+			+
O4				+		+			+
O5					+	+		+	+
input						+	+		+

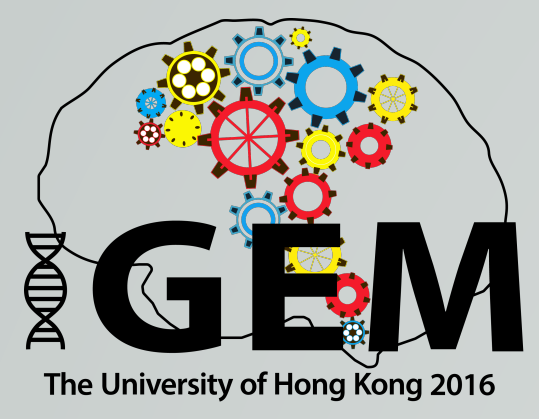




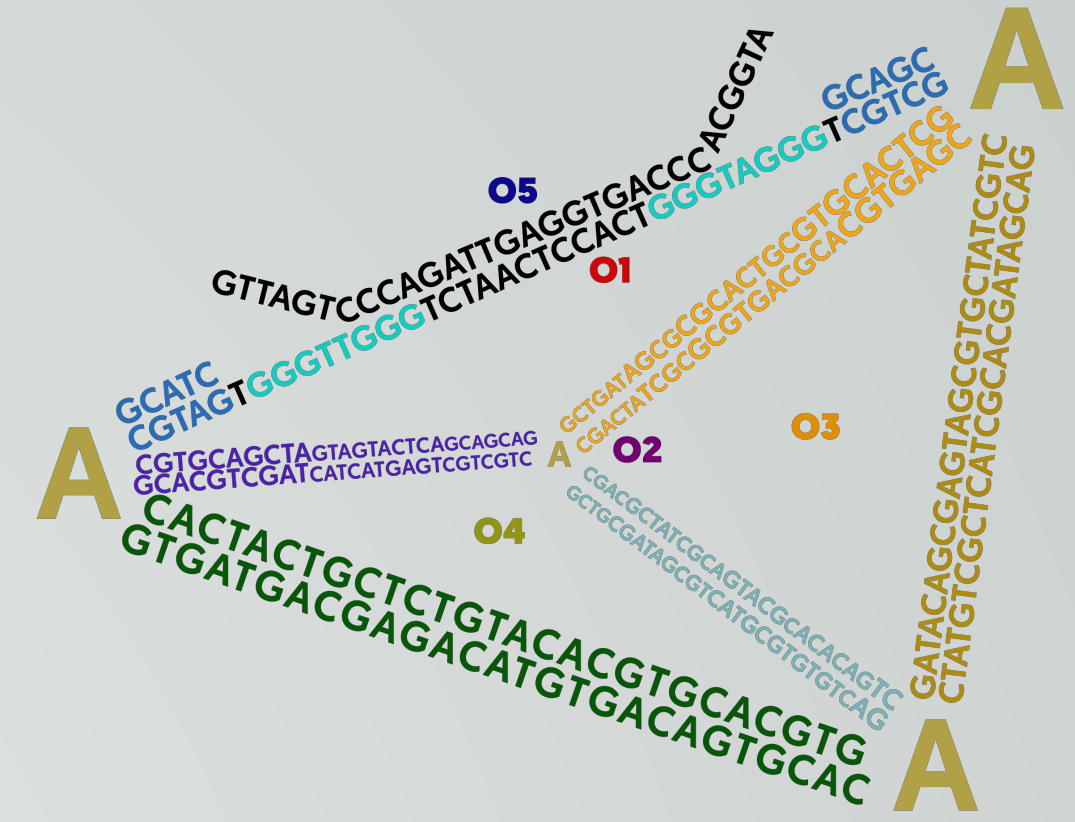
# Results

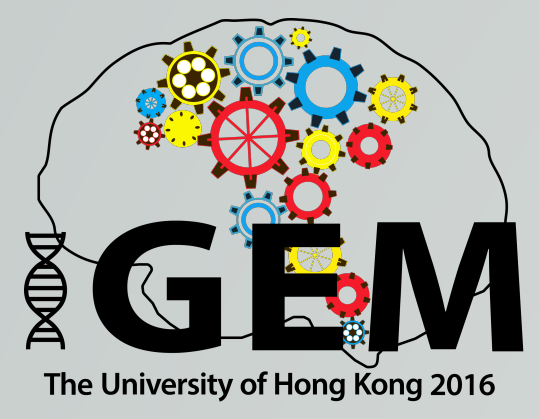




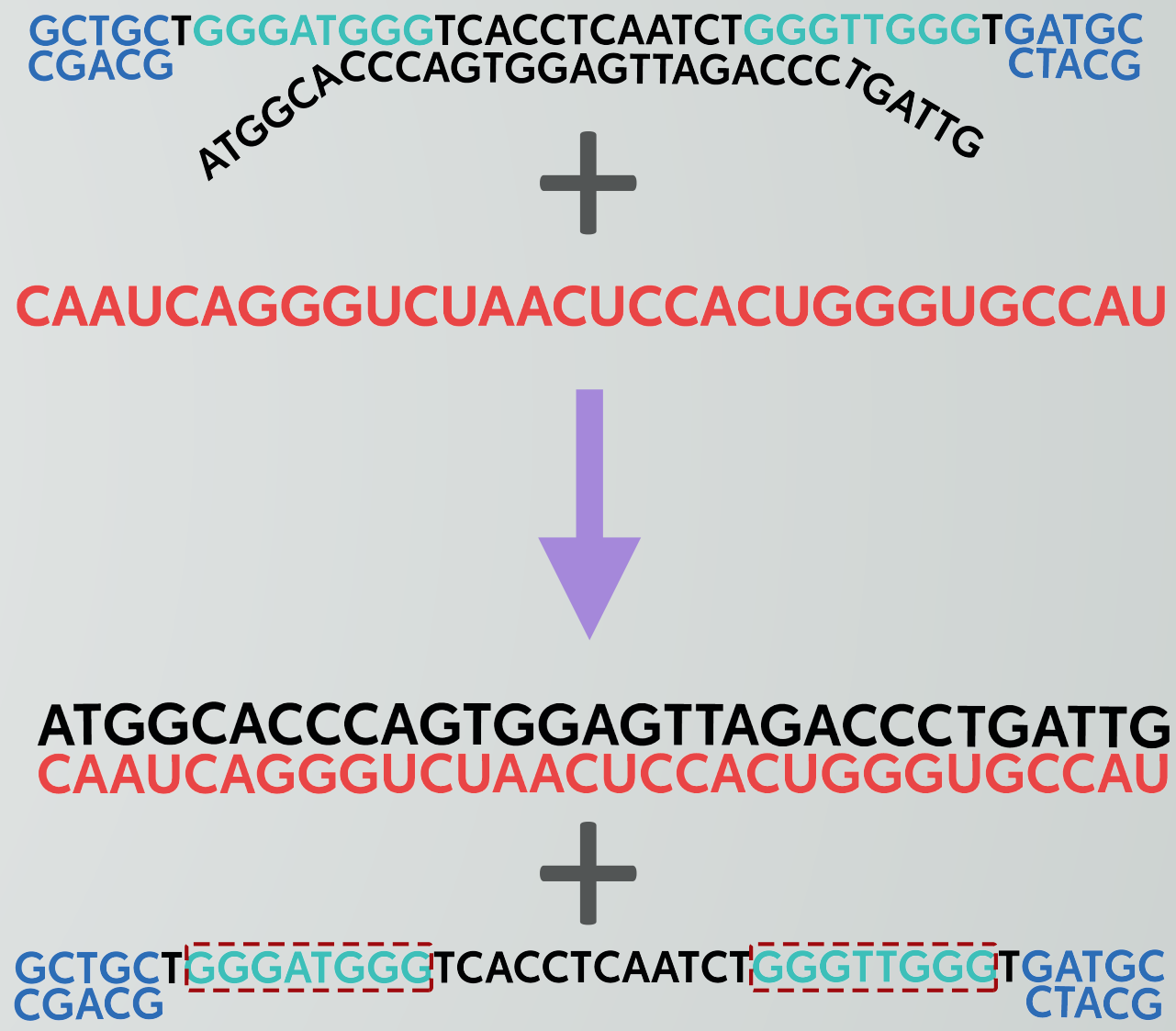


# Results

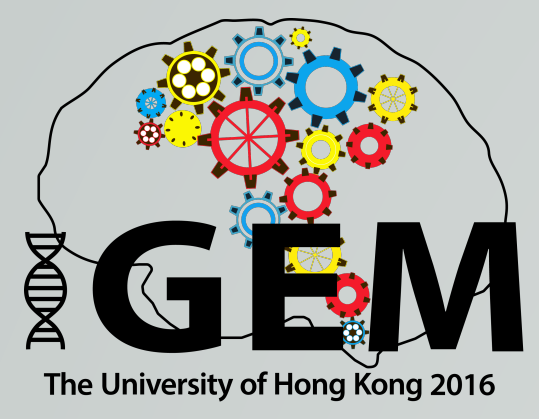




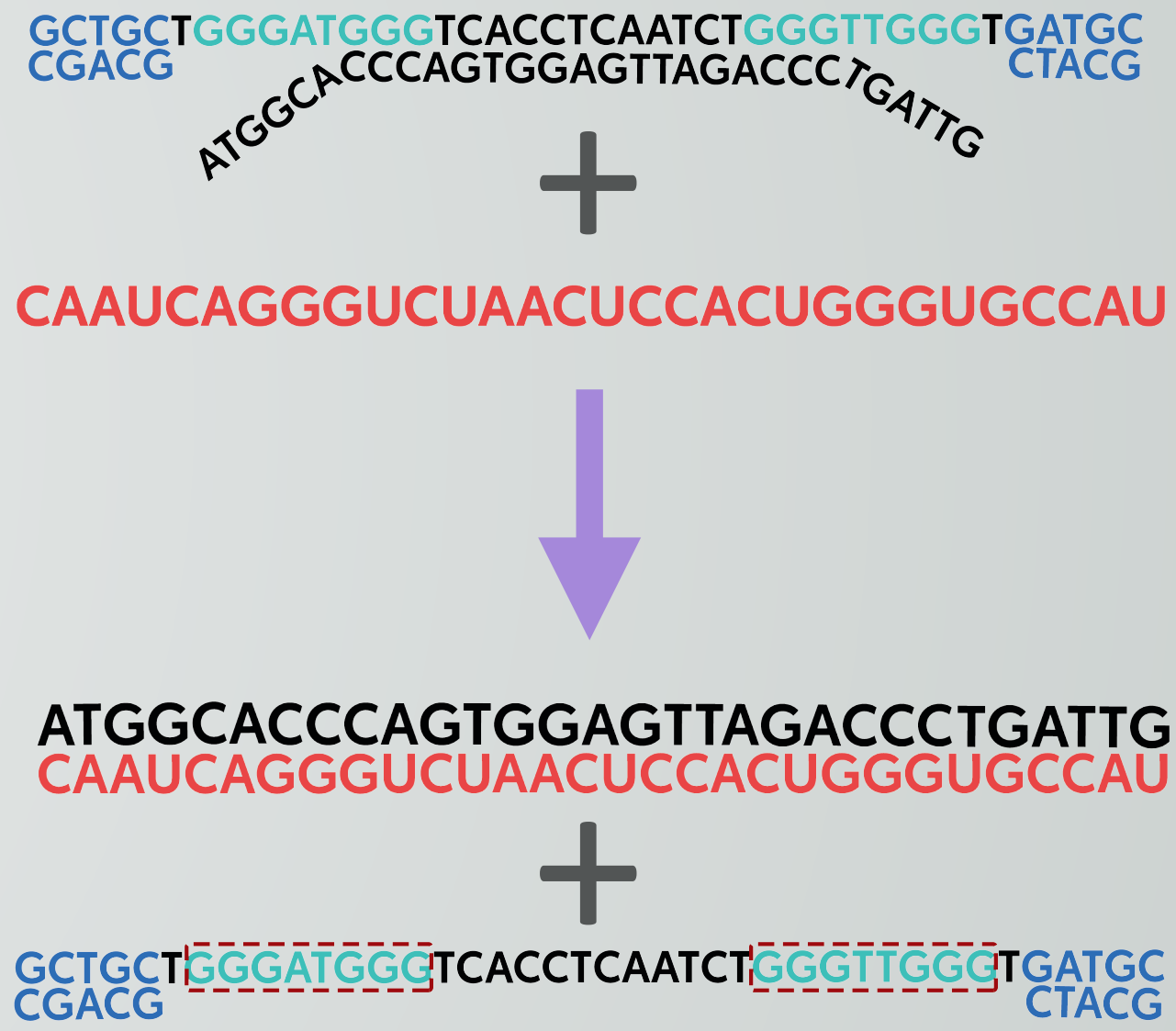
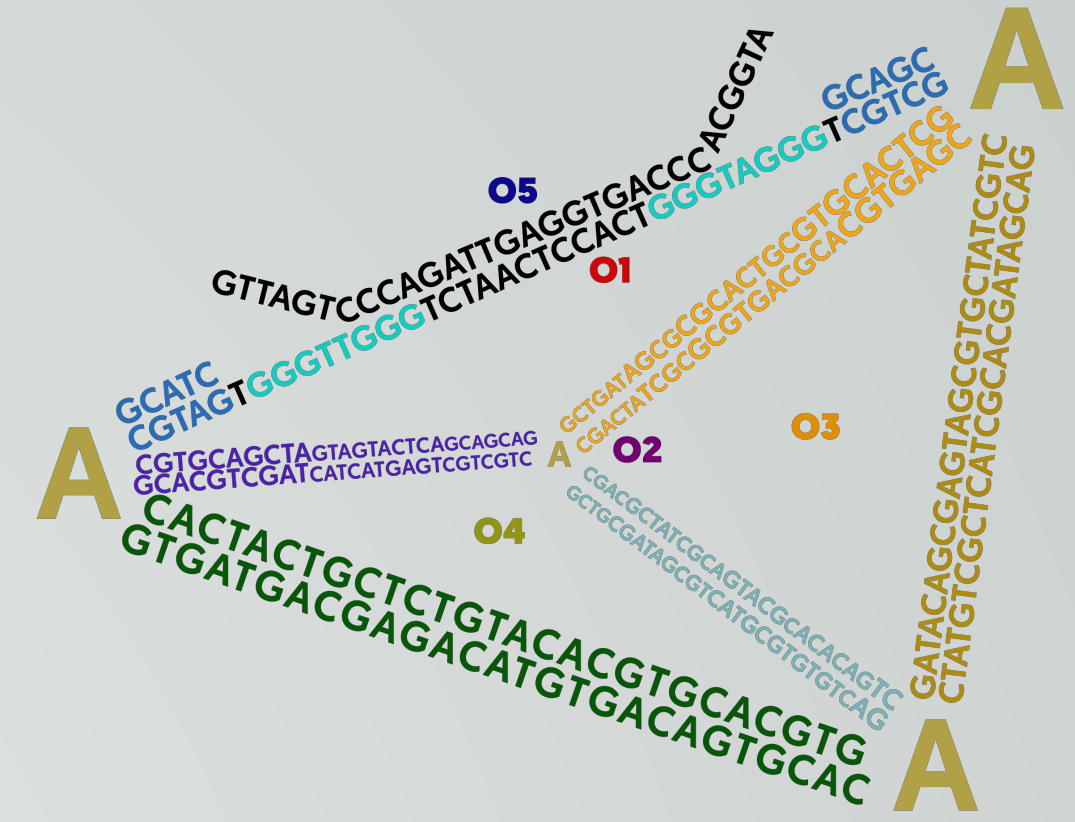
# Results







# Results





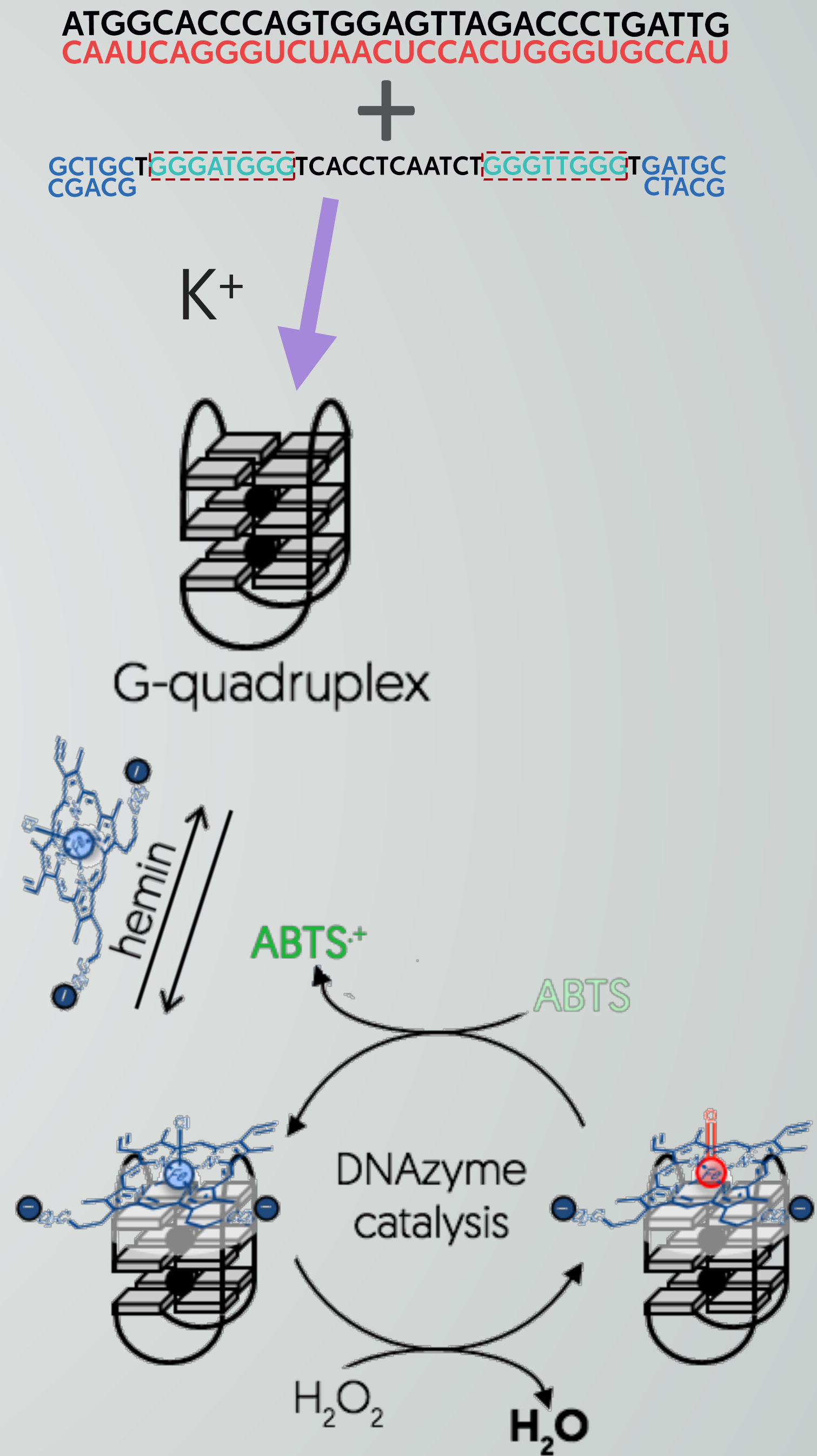
# Results



Tetrahedron	+	+	+
Input	+		
Random input		+	

# Results

Tetrahedron	+	+	+
Input	+		
Random input		+	



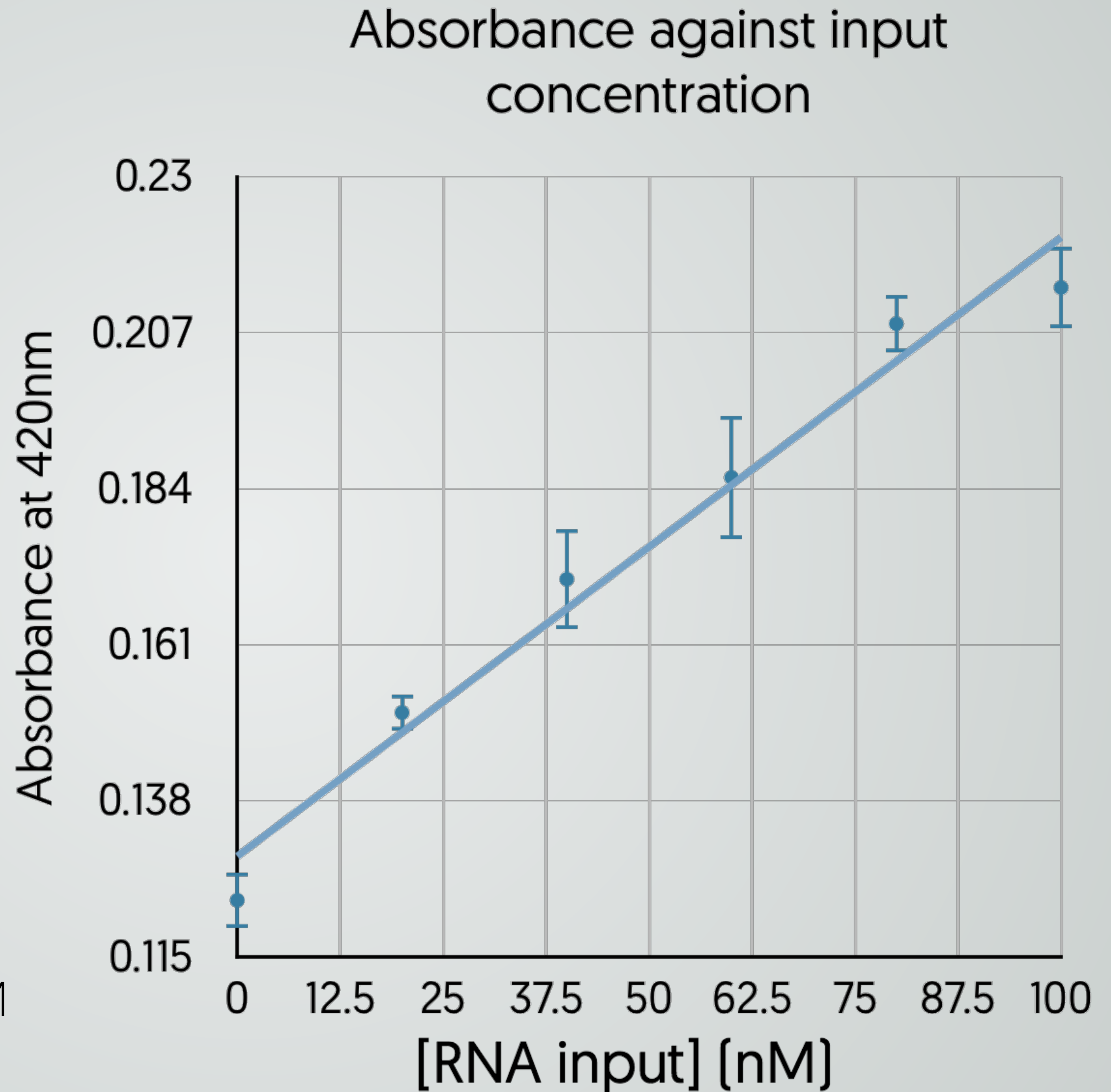


# Results

$$y=0.0009x+0.1298[R^2=0.9739]$$

LOD=17.2nM


Typical serum conc. = 72-720nM  
[0.5-5ng/ $\mu$ l]





# Absorbance against input concentration

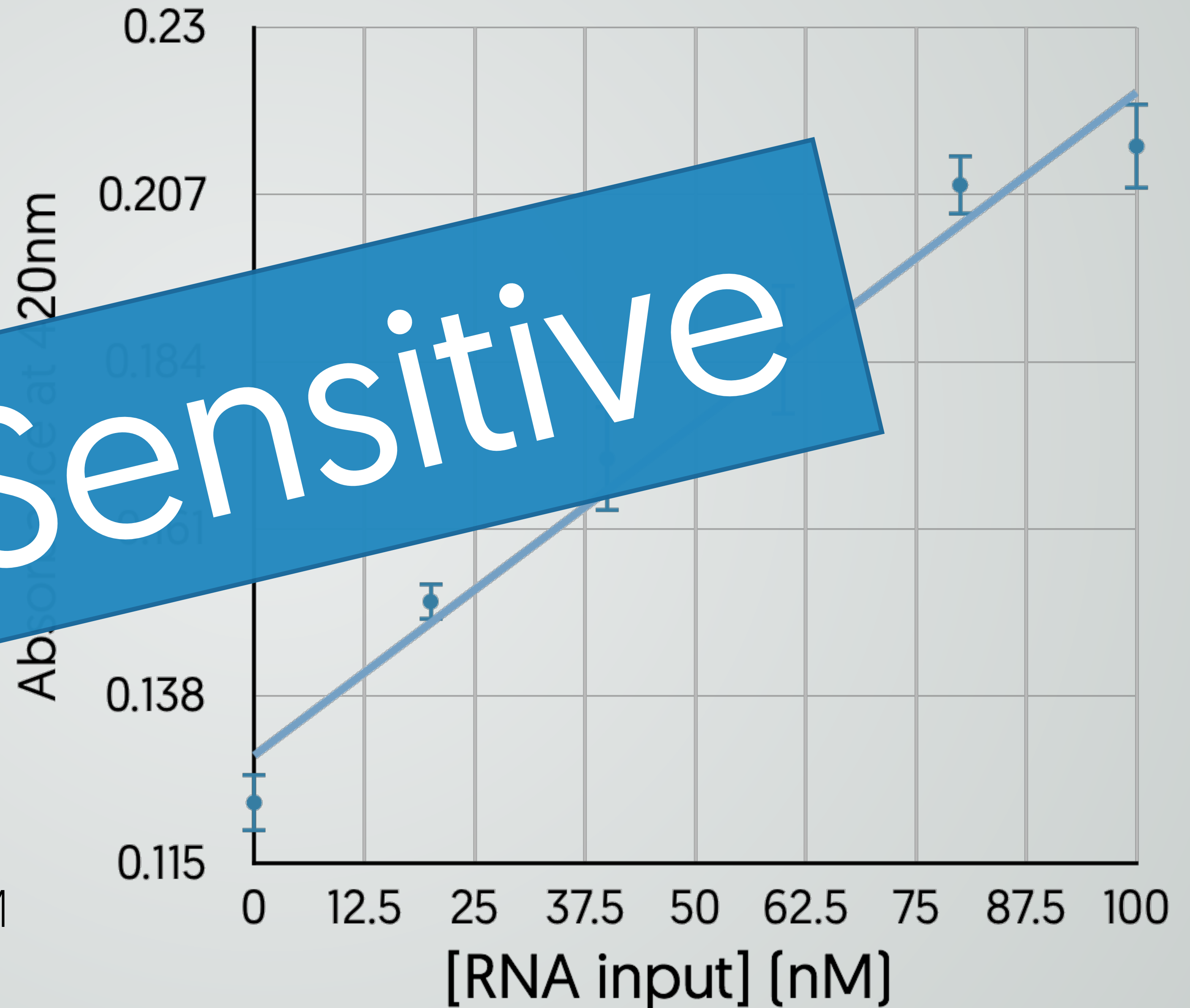
Results

 **Sensitive**

$$y=0.0009x+0.1298[R^2=0.9739]$$

LOD=17.2nM

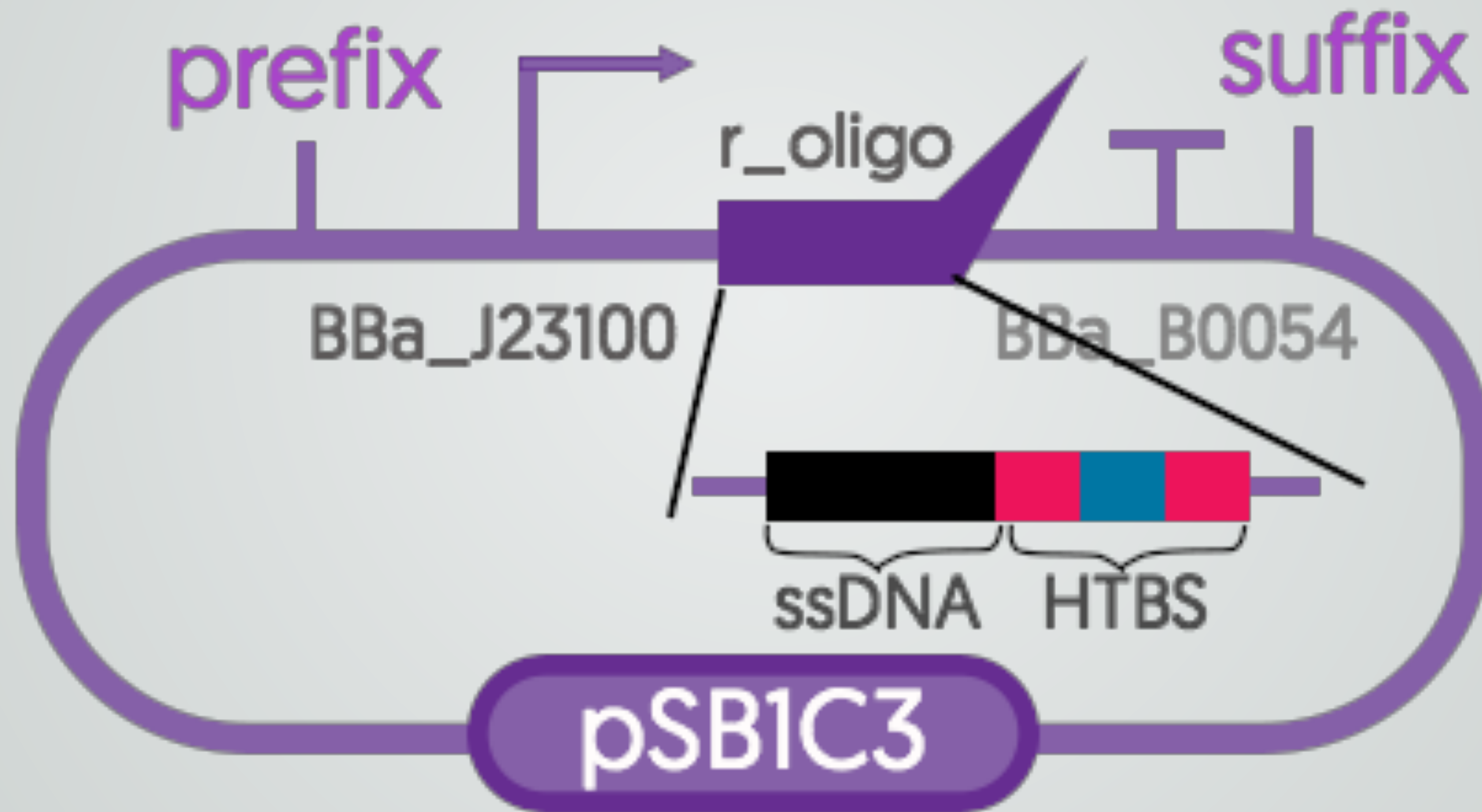
Typical serum conc. = 72-720nM  
[0.5-5ng/ $\mu$ l]





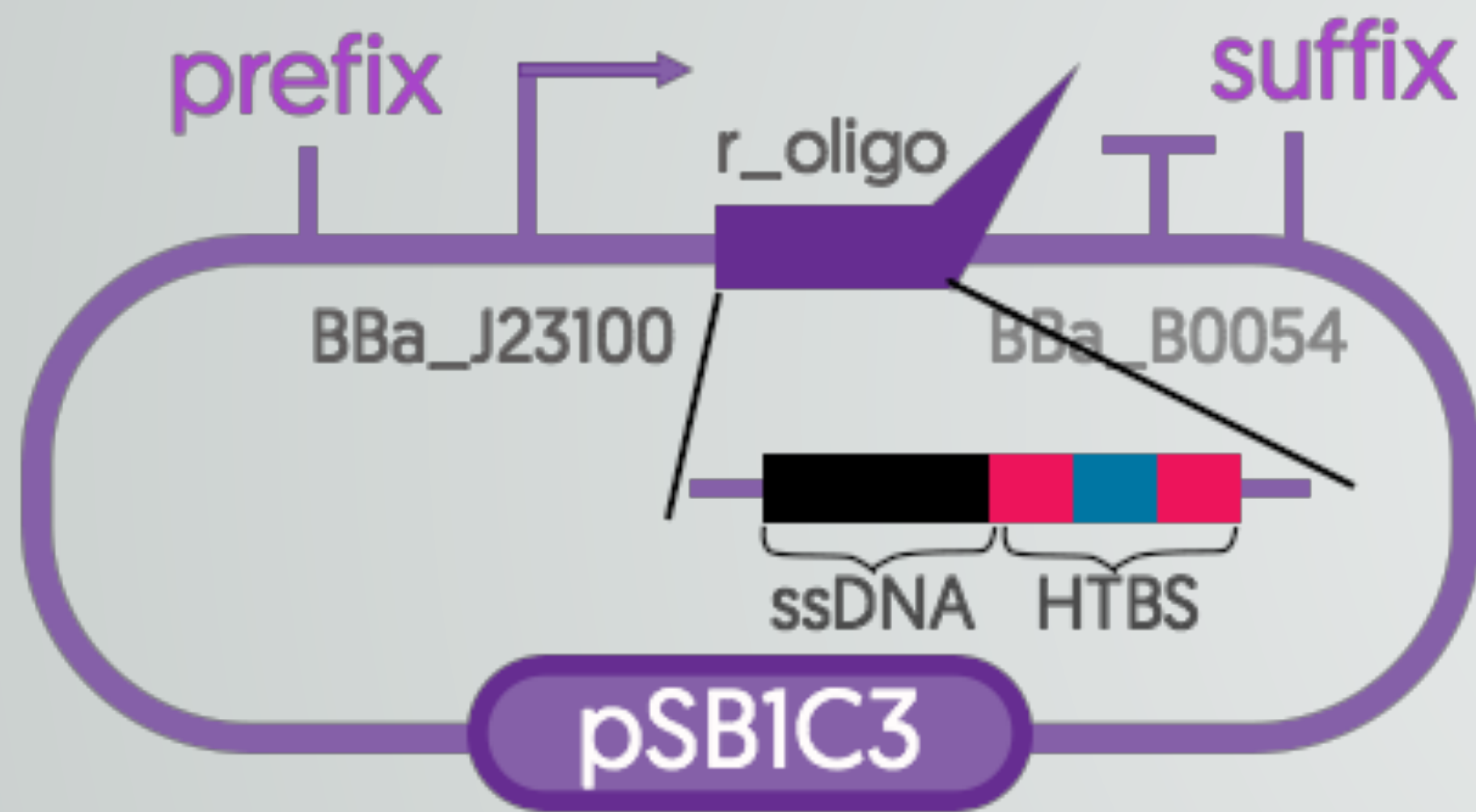
# Device

# Device





# Device



# Future Work



# Future Work

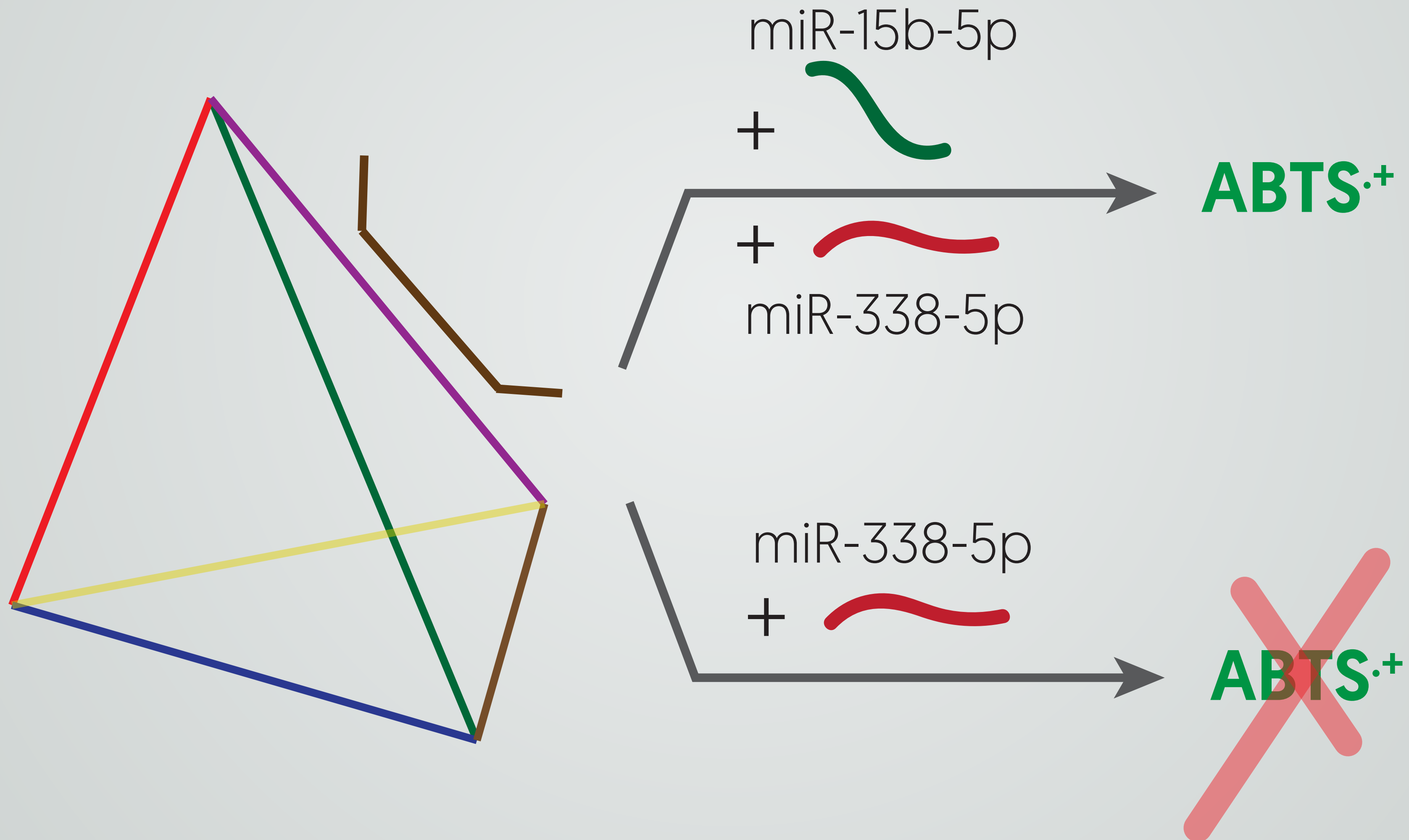
TEM





# Future Work

# Future Work





# Future Work



# Future Work



Easily immobilized  
on surface

# Future Work



Easily immobilized  
on surface

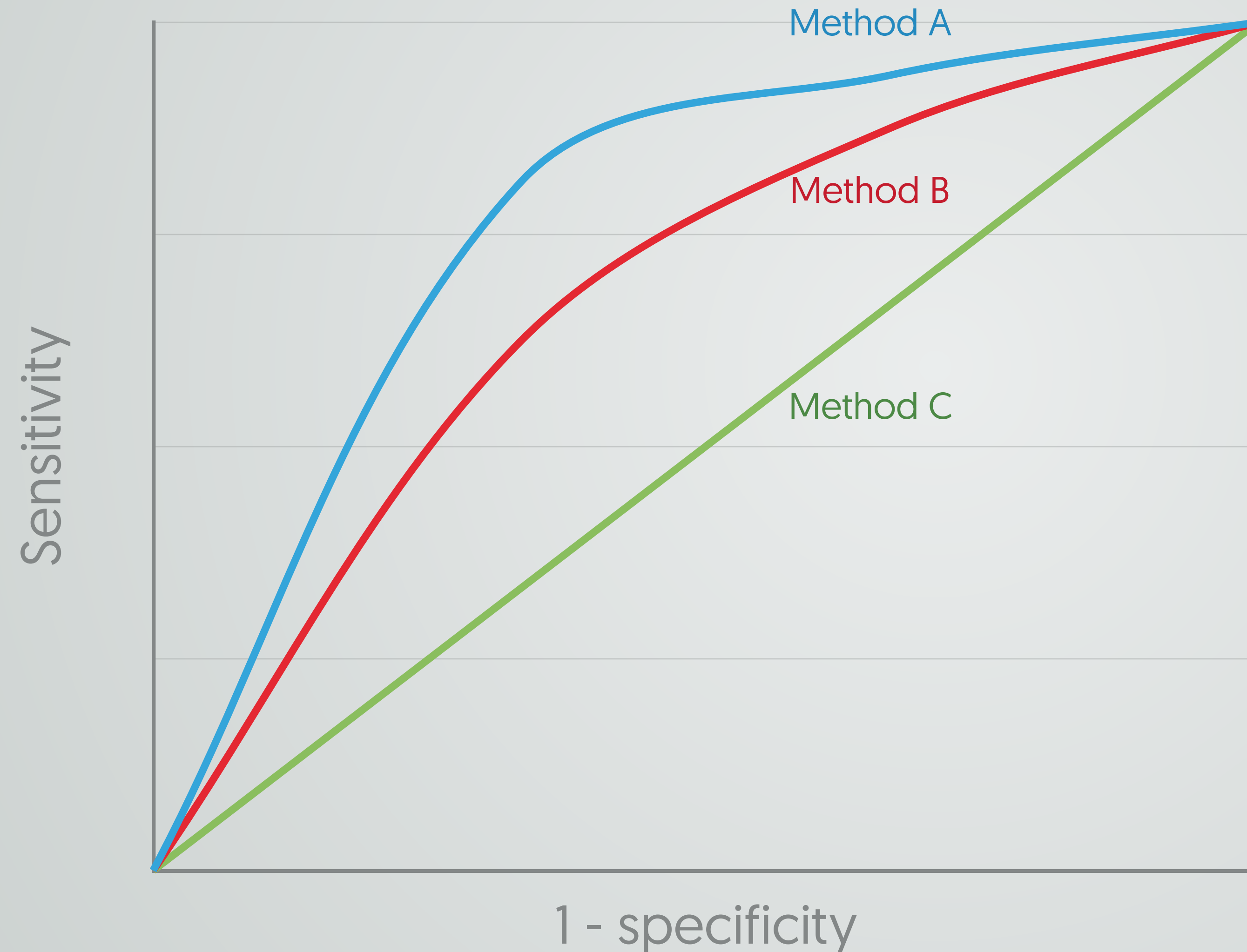
## Paper diagnostics



# Future Work



# Future Work



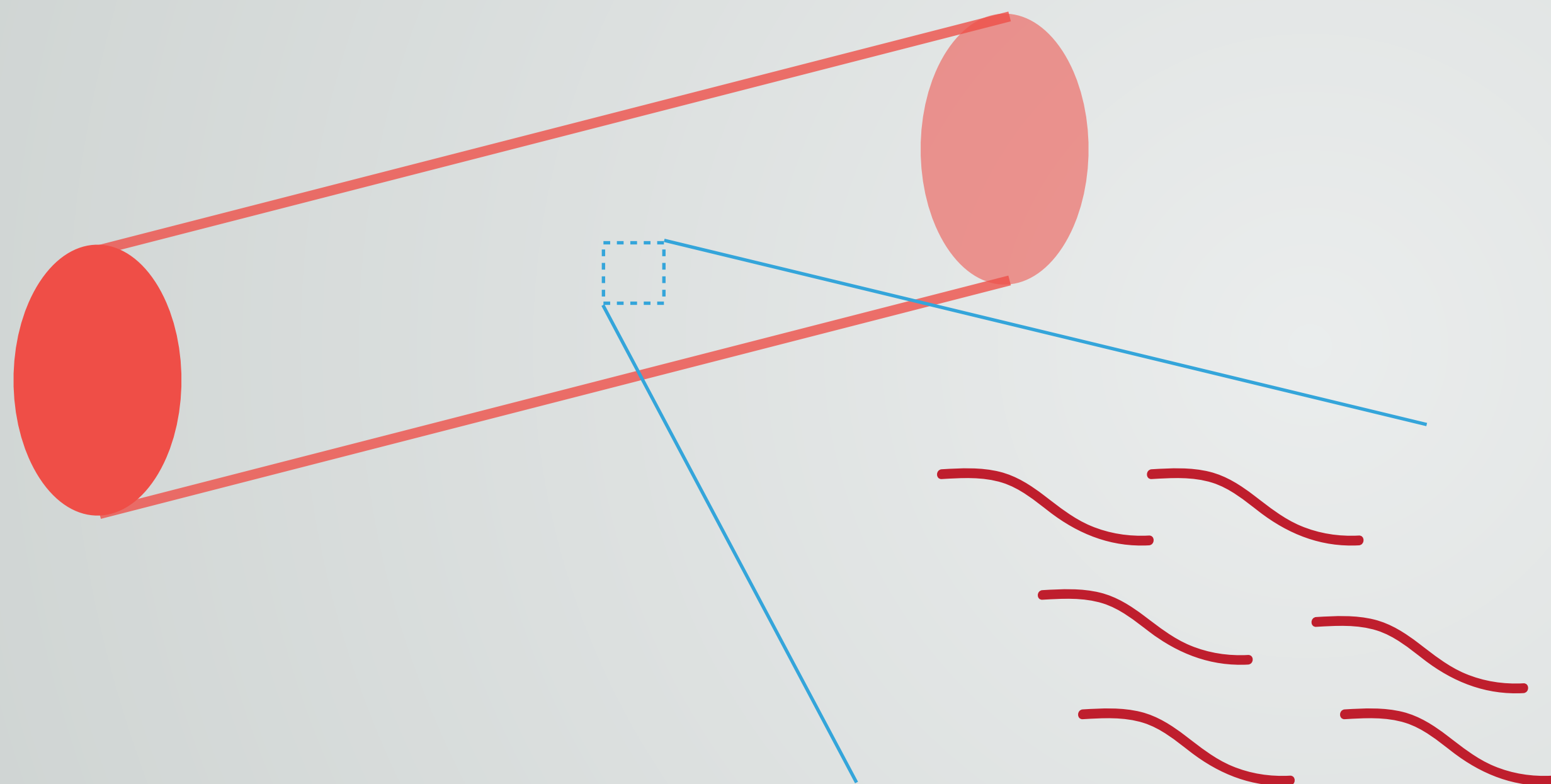
Method A





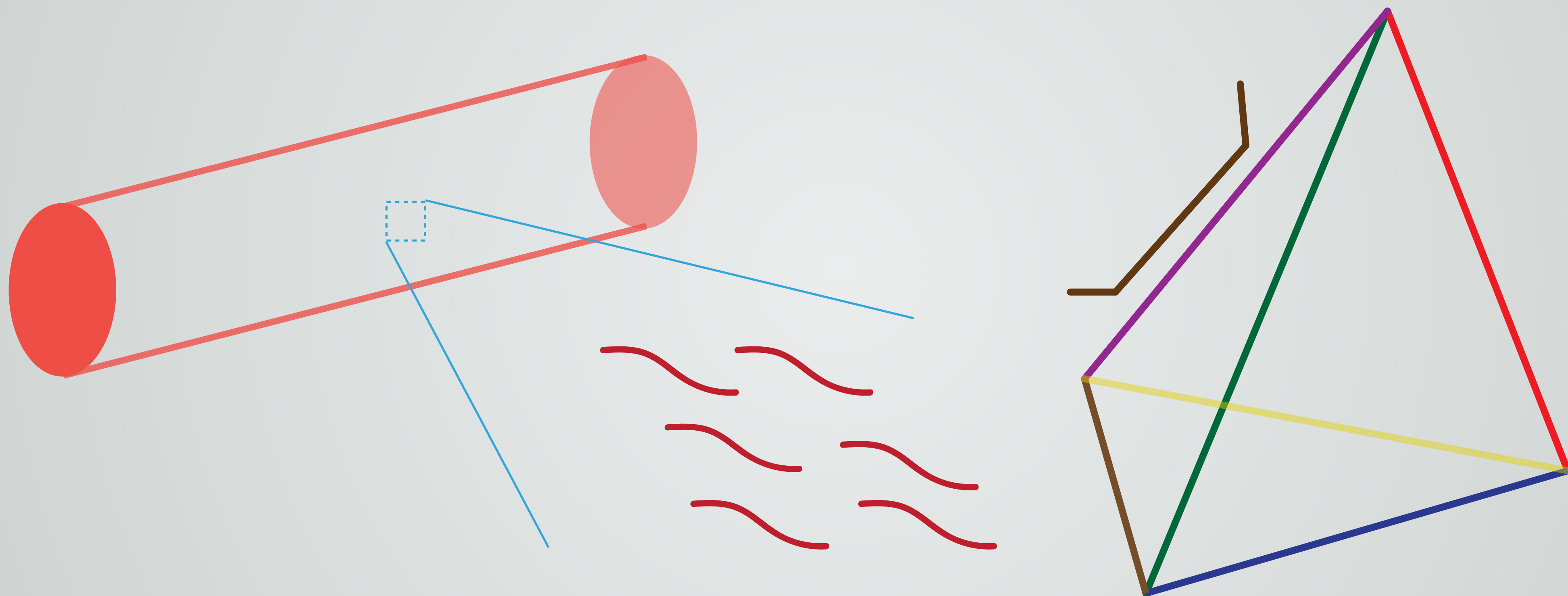
# Future Work

# Future Work



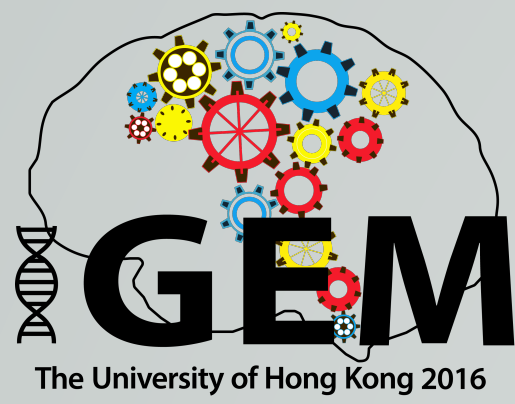


# Future Work





# Future Work



# Future Work

Lower error of per-base synthesis





# Human Practices



# Human Practices

Synbio with humanities



# Human Practices

Synbio with humanities

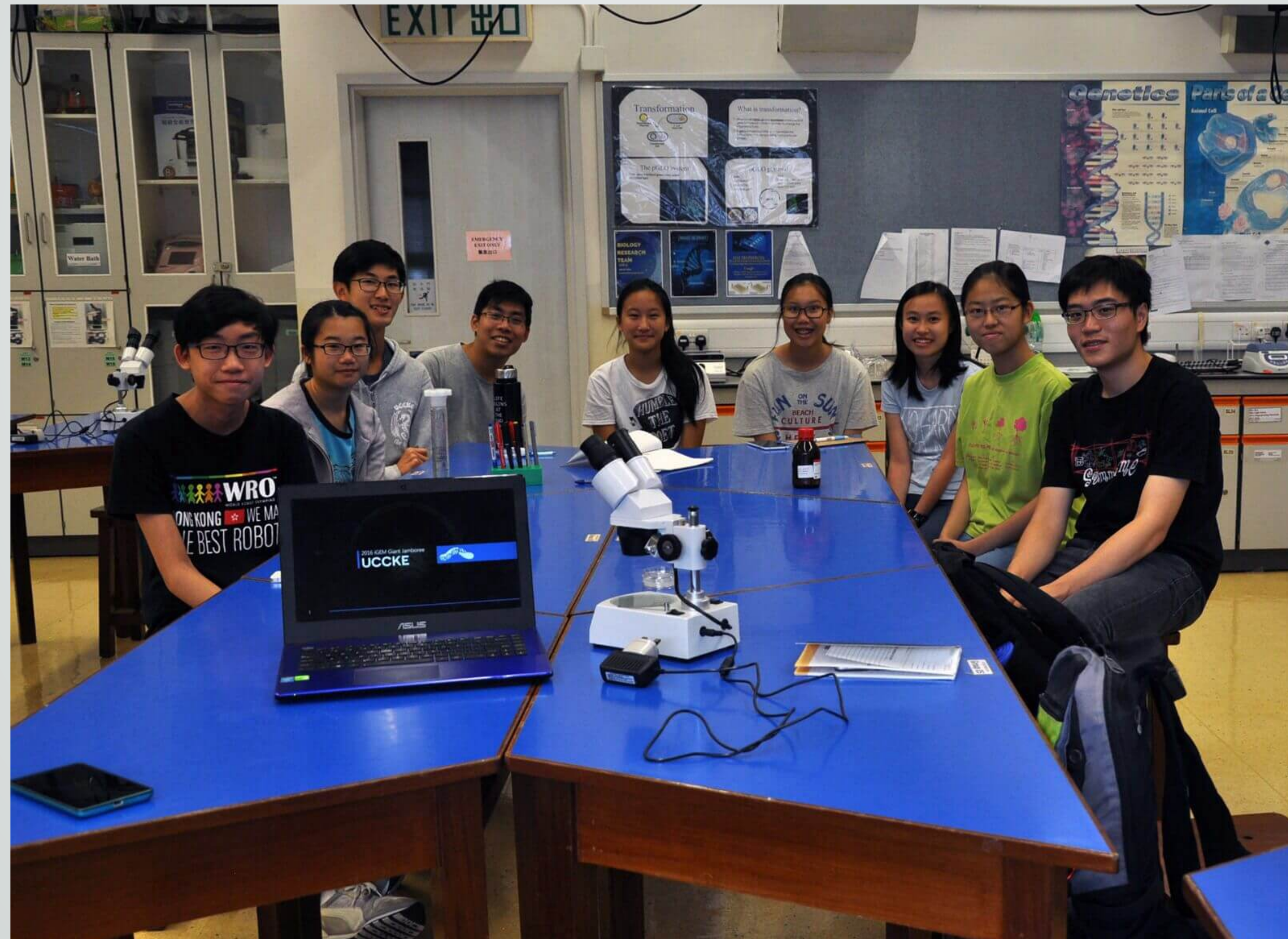




# Human Practices



# Human Practices







# Human Practices

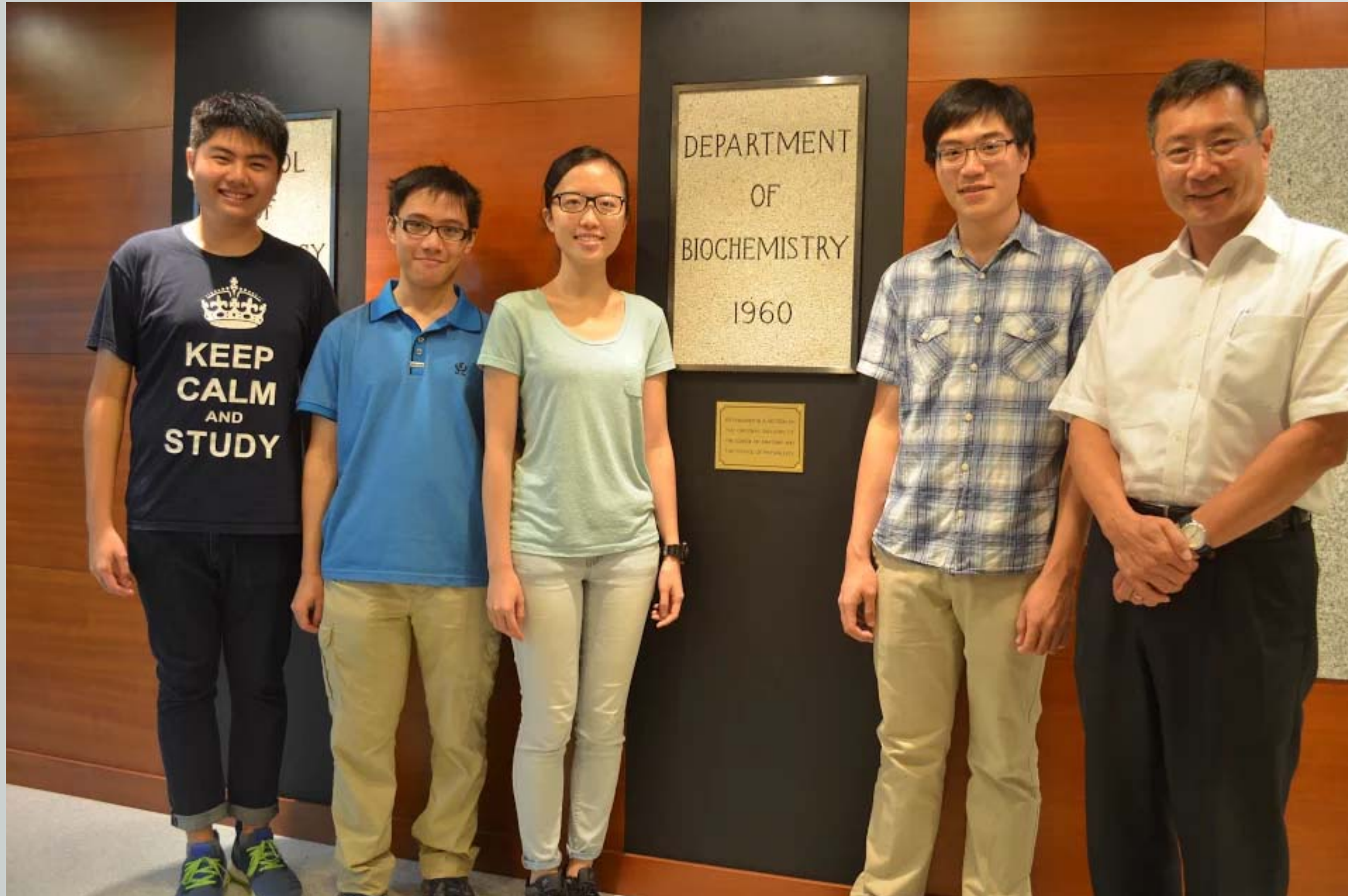


# Human Practices





# Human Practices



## Professor Danny Chan

SY and HY Cheng Professor in Stem Cell Biology  
and Regenerative Medicine;

Assistant Dean (Research Postgraduate Studies), LKS  
Faculty of Medicine;





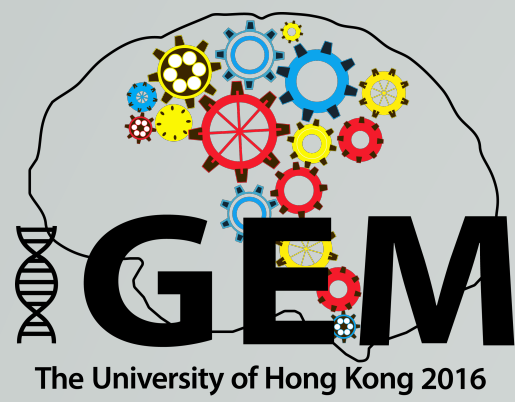
# Human Practices

## Risk Assessment





# Our journey

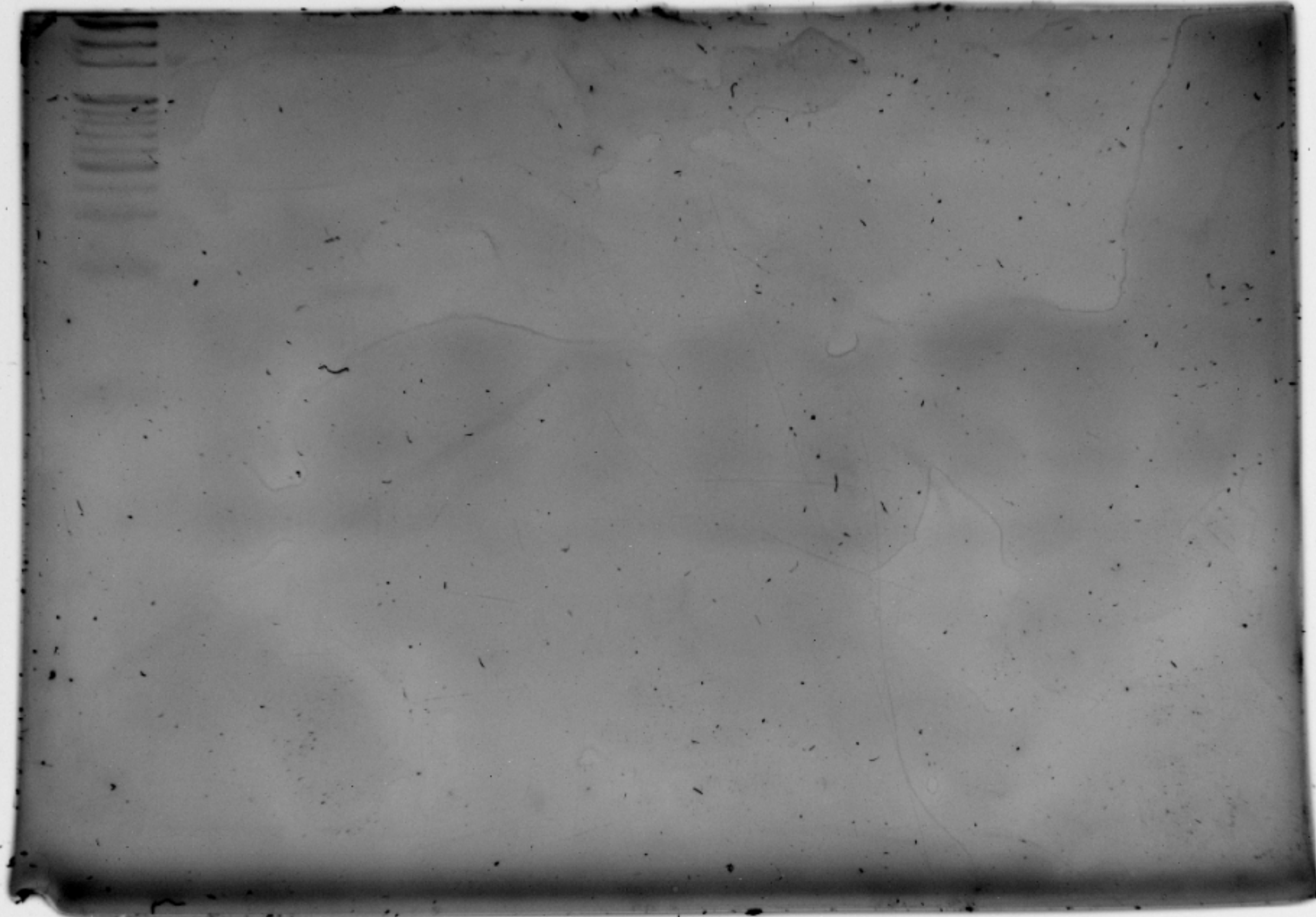


# Our journey

En route from 0 to 1.



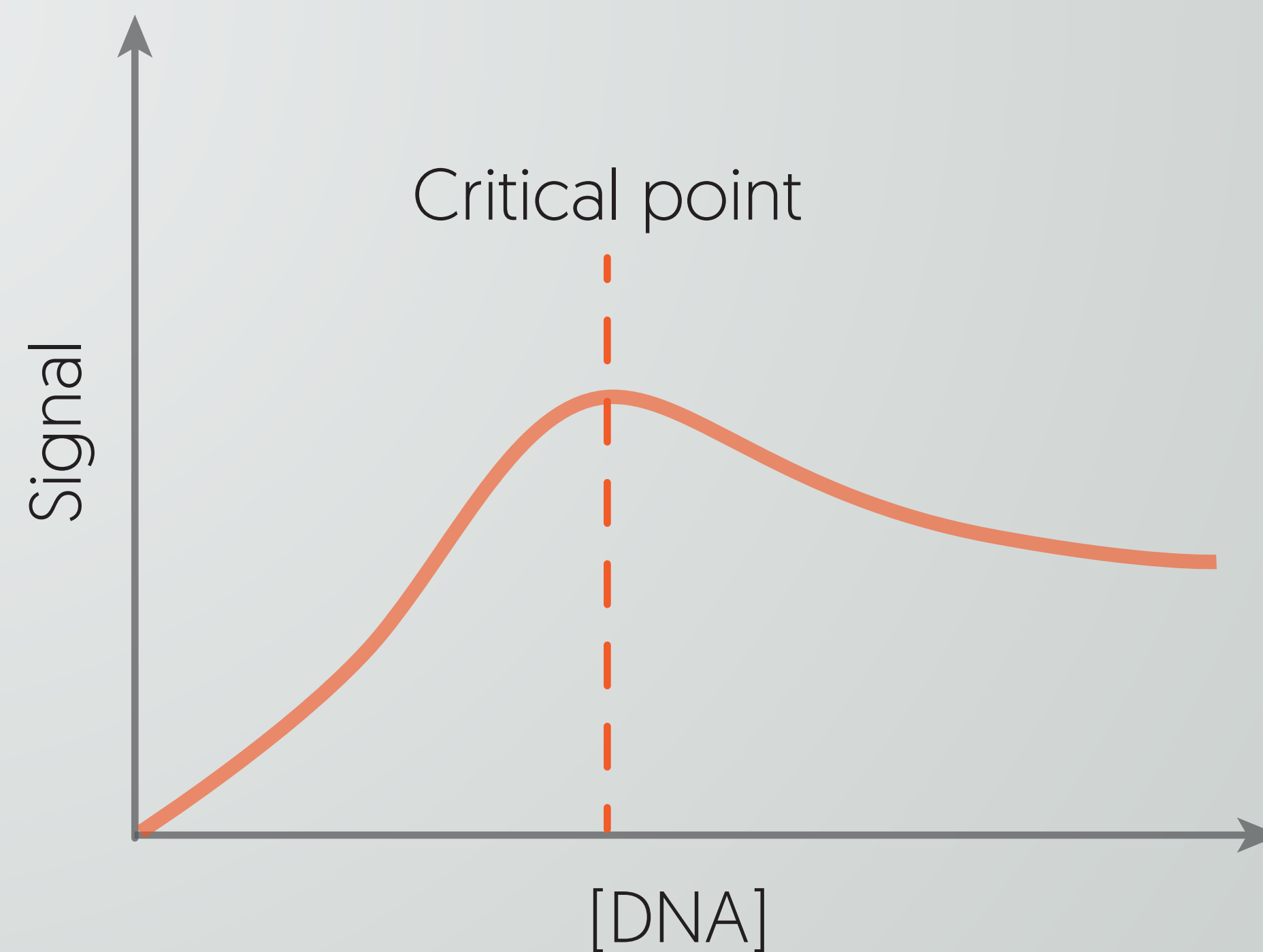
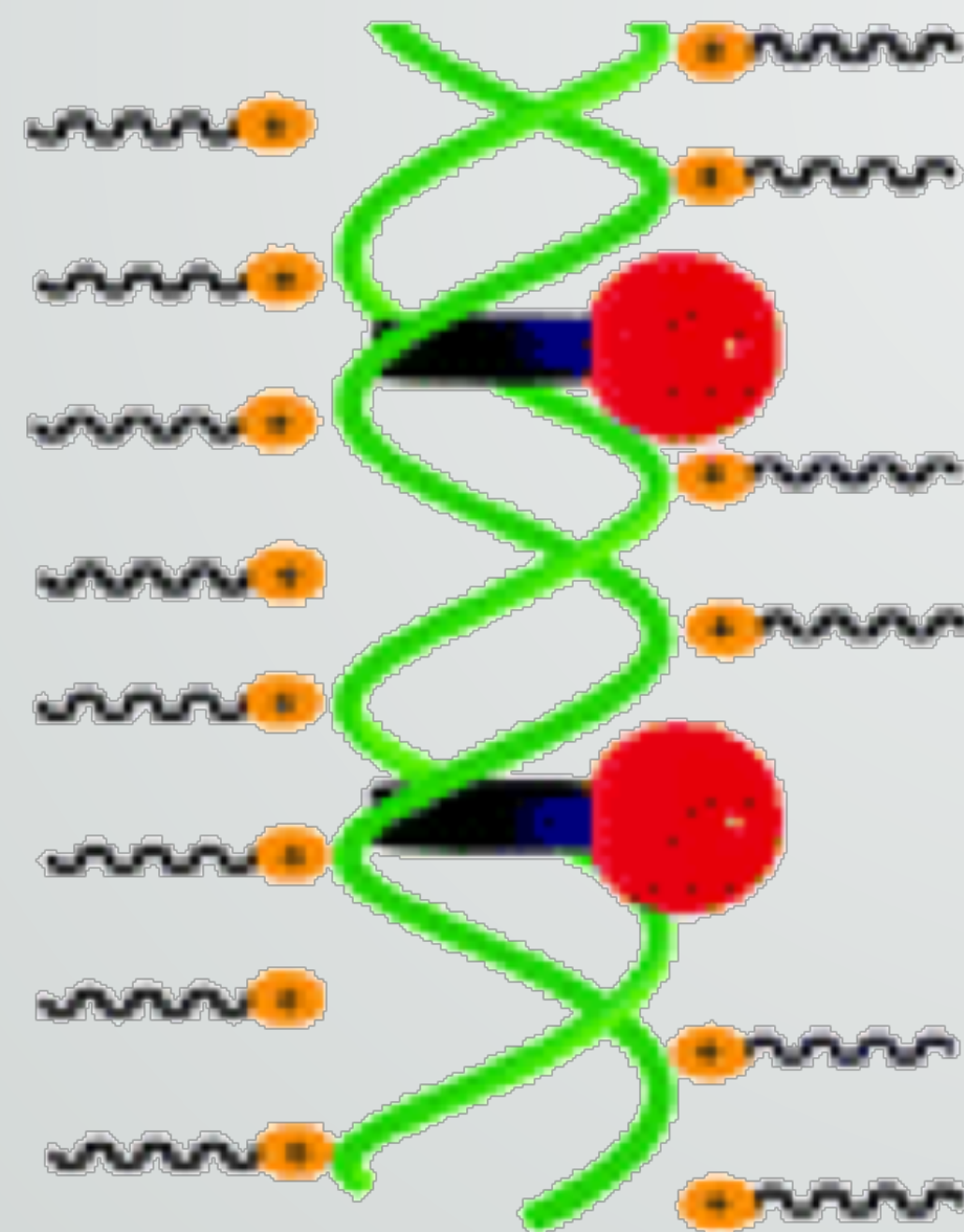
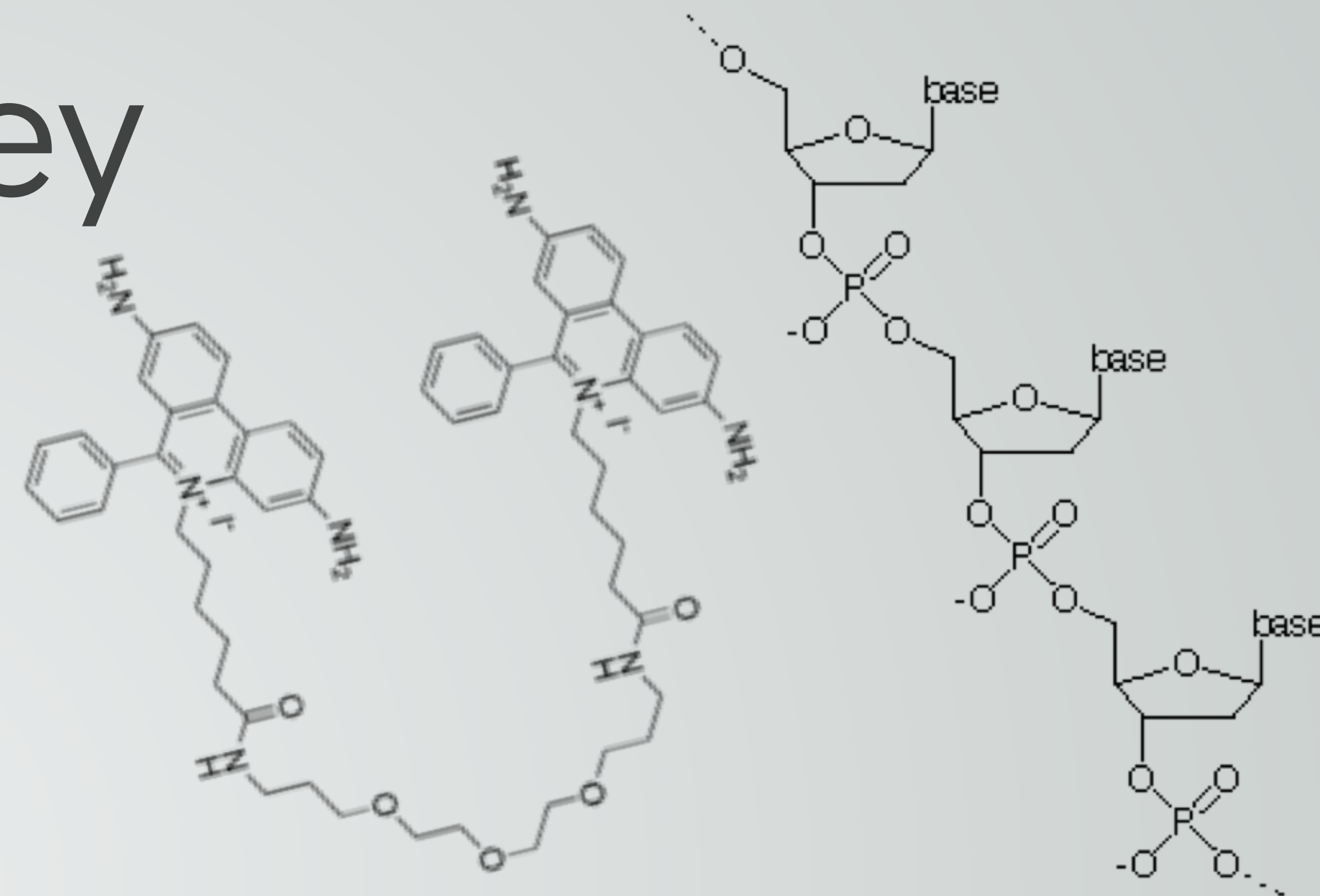
# Our journey



Loading:  
150nM, 6uL  
w/ NEB Loading Dye  
Staining:  
Gel Red, post-staining, 30 minutes



# Our journey

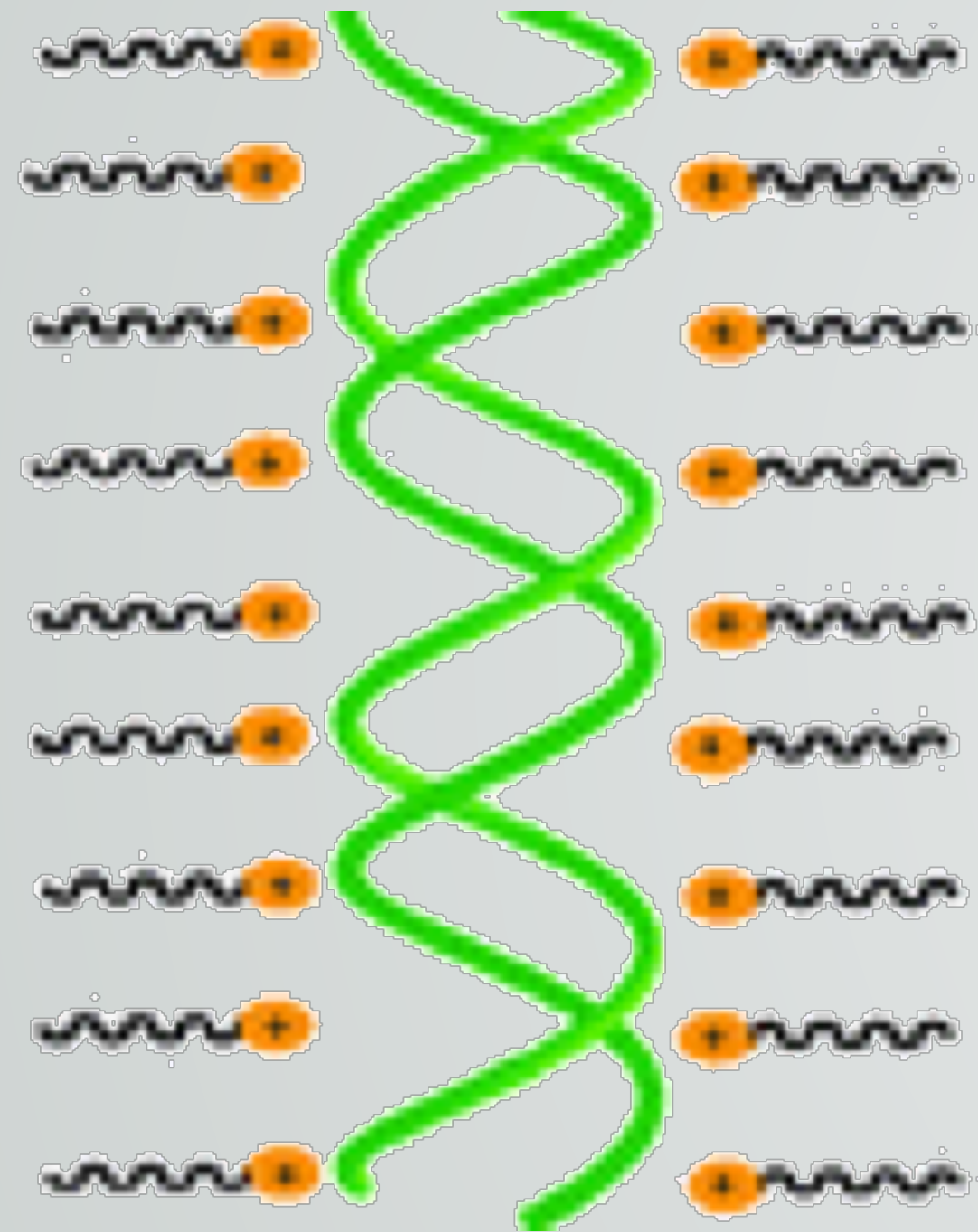




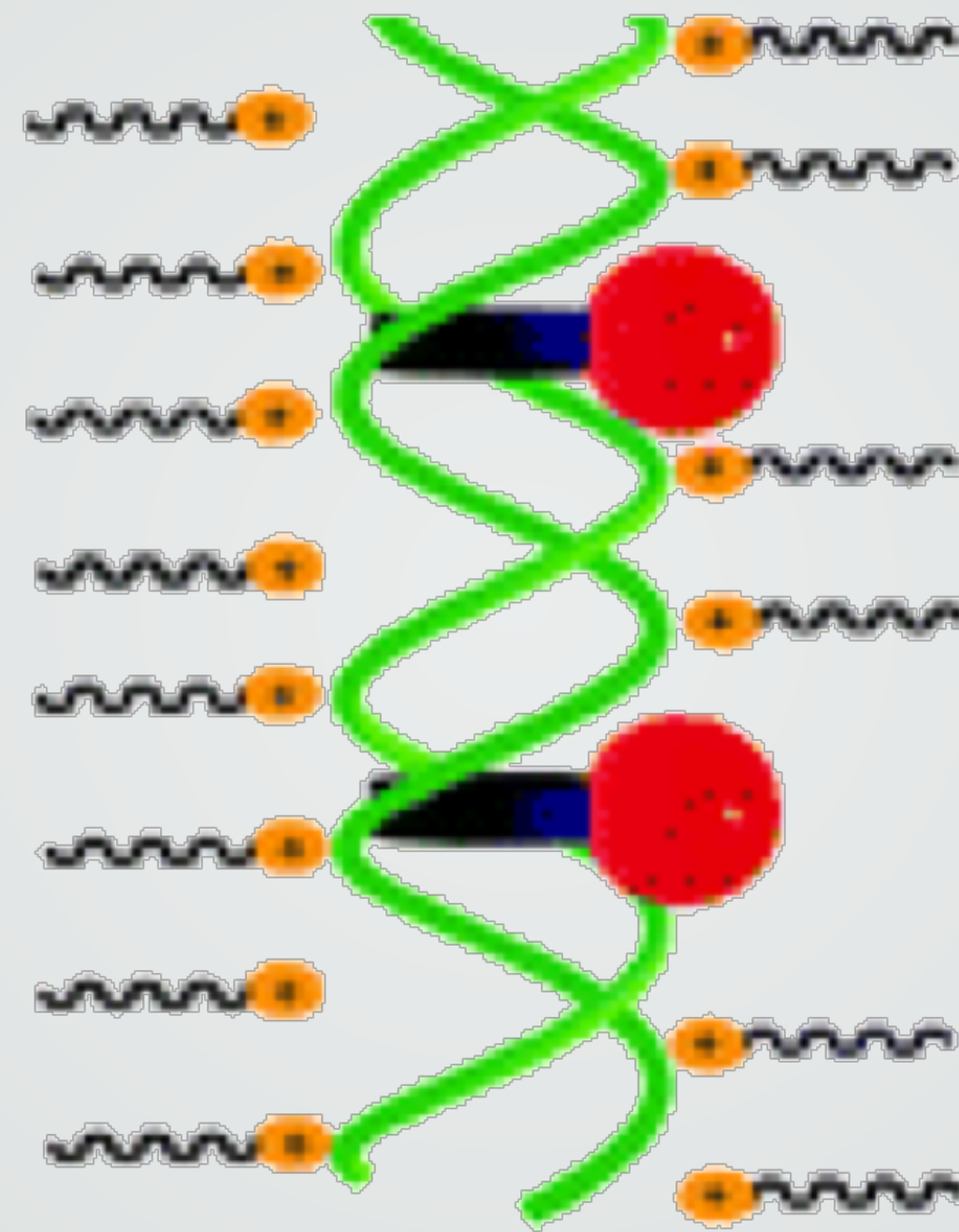
# Our journey



# Our journey



MORE



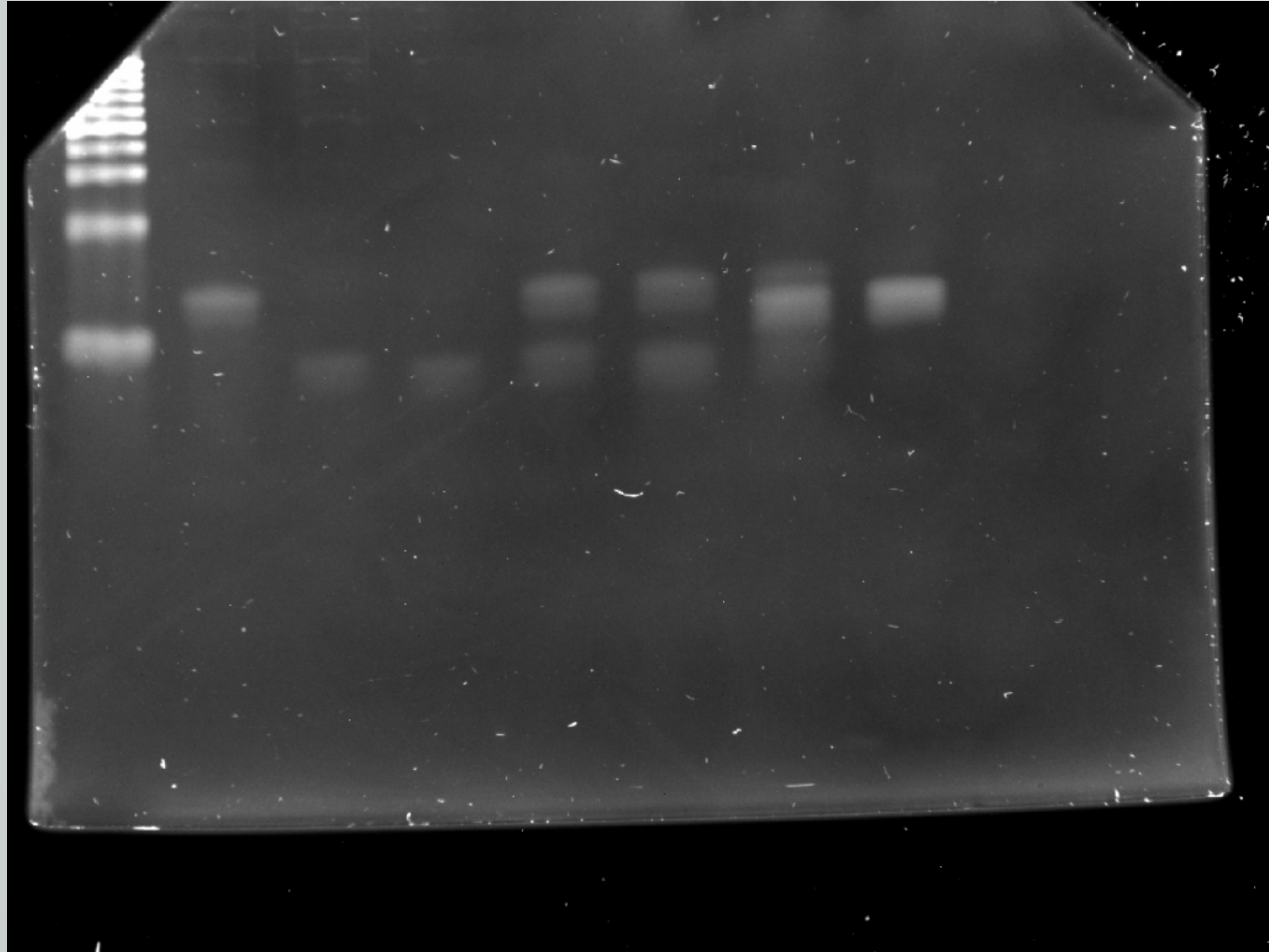
MORE



MORE



# Our journey



Loading:  
1uM, 6uL  
w/ NEB Loading Dye  
Staining:  
Gel Red, post-staining, 30 minutes



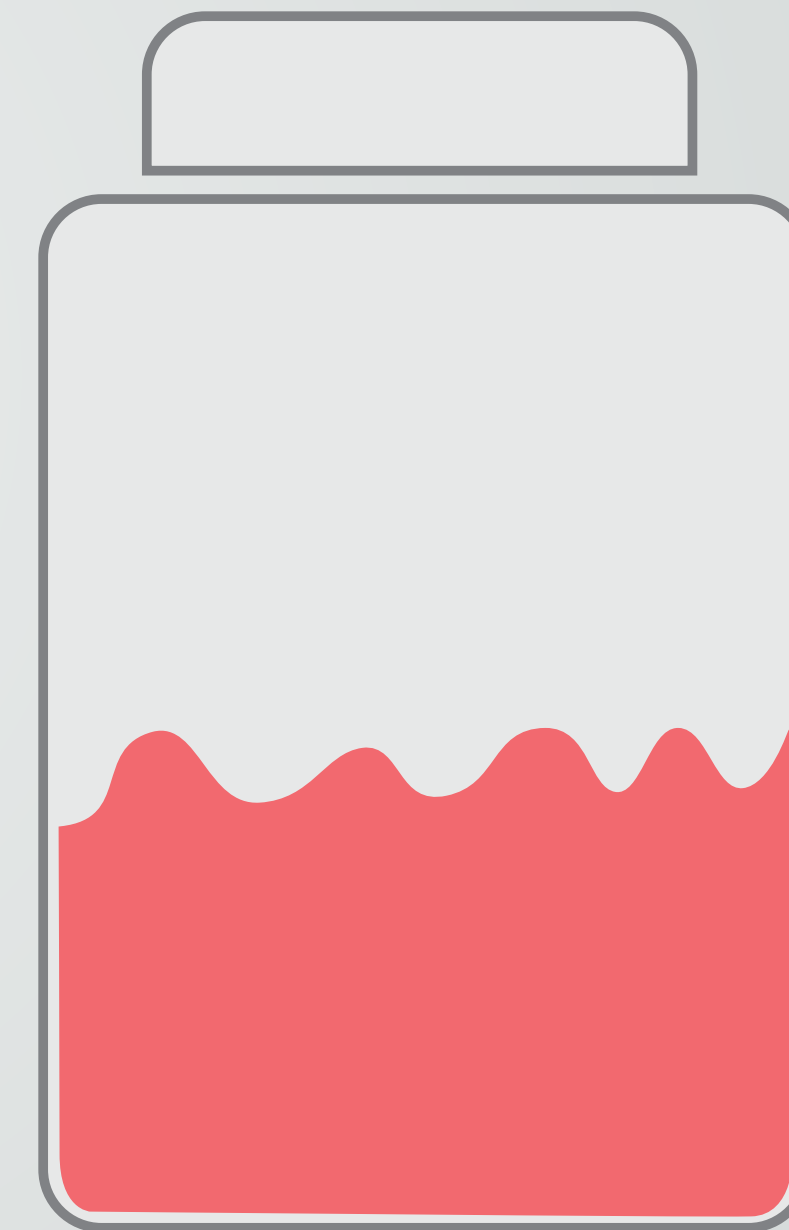
# Our journey

# Concerns



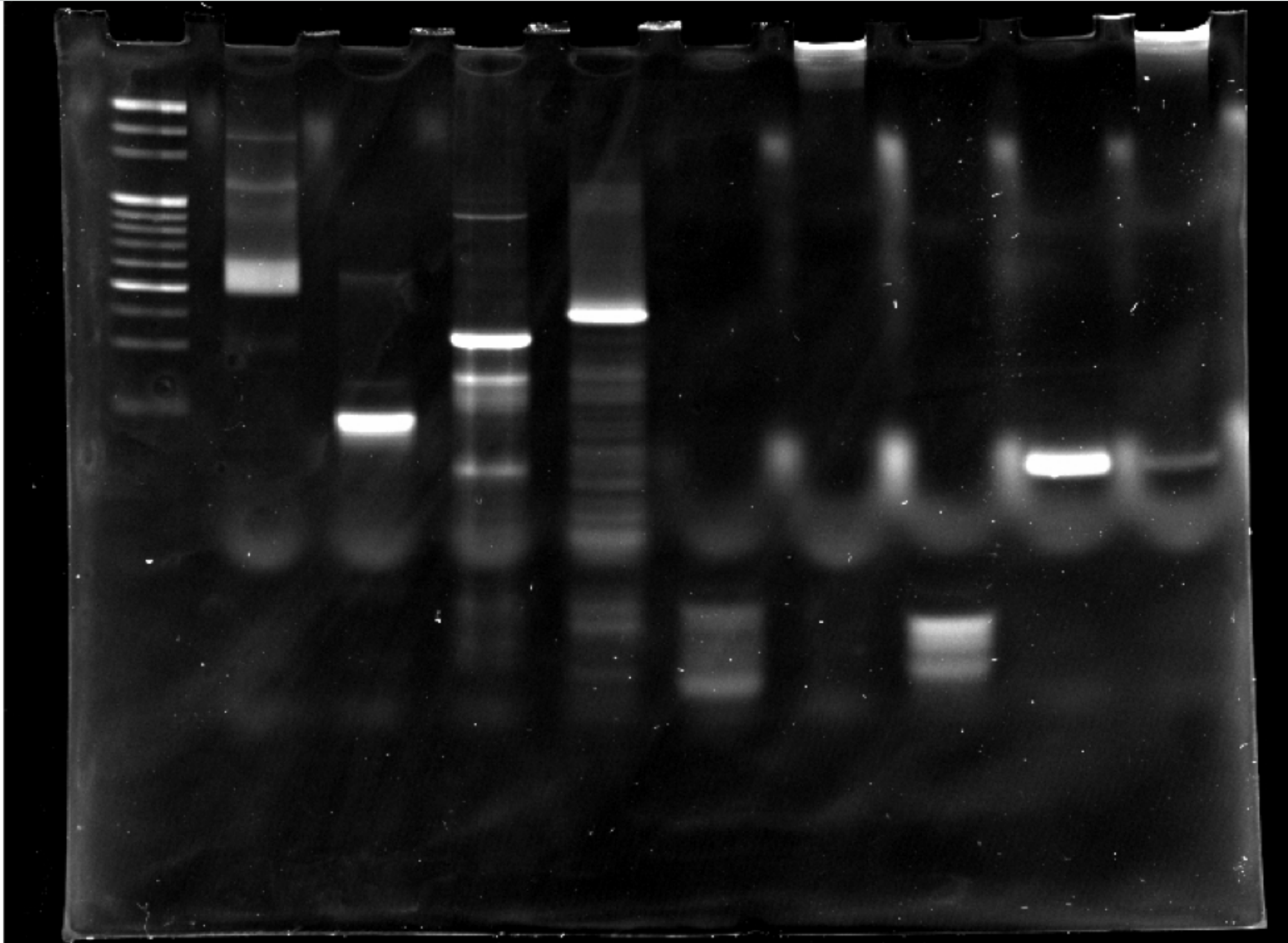
# Our journey

# Concerns



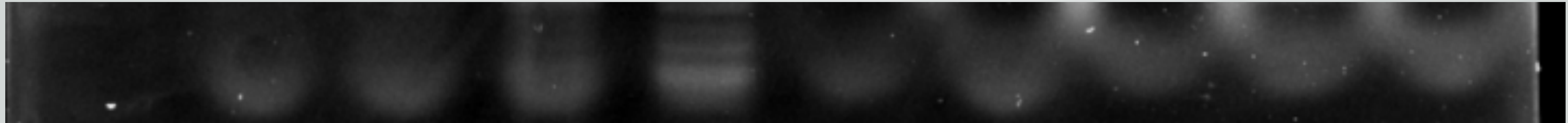


# Our journey

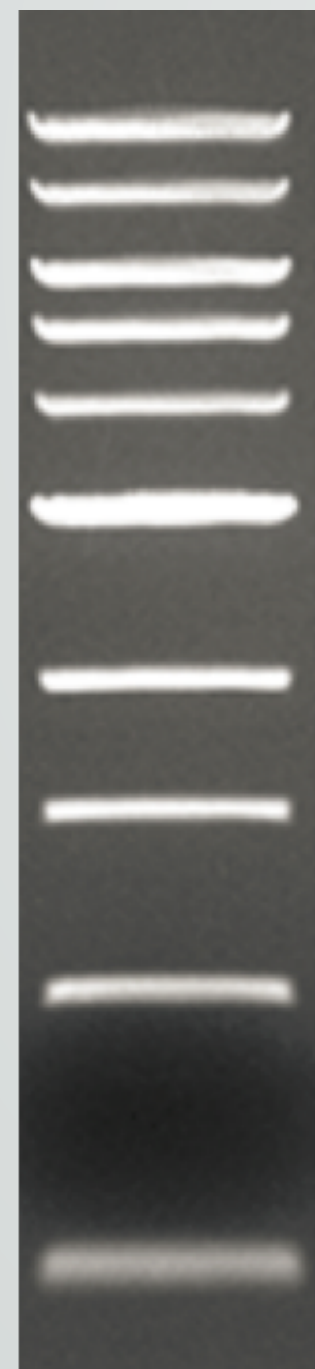


Loading:  
1uM, 6uL  
w/ NEB Loading Dye  
Staining:  
Gel Red, pre-staining in loading mixtures

# Our journey



Ladder



UV Shadows

← UV  
shadow

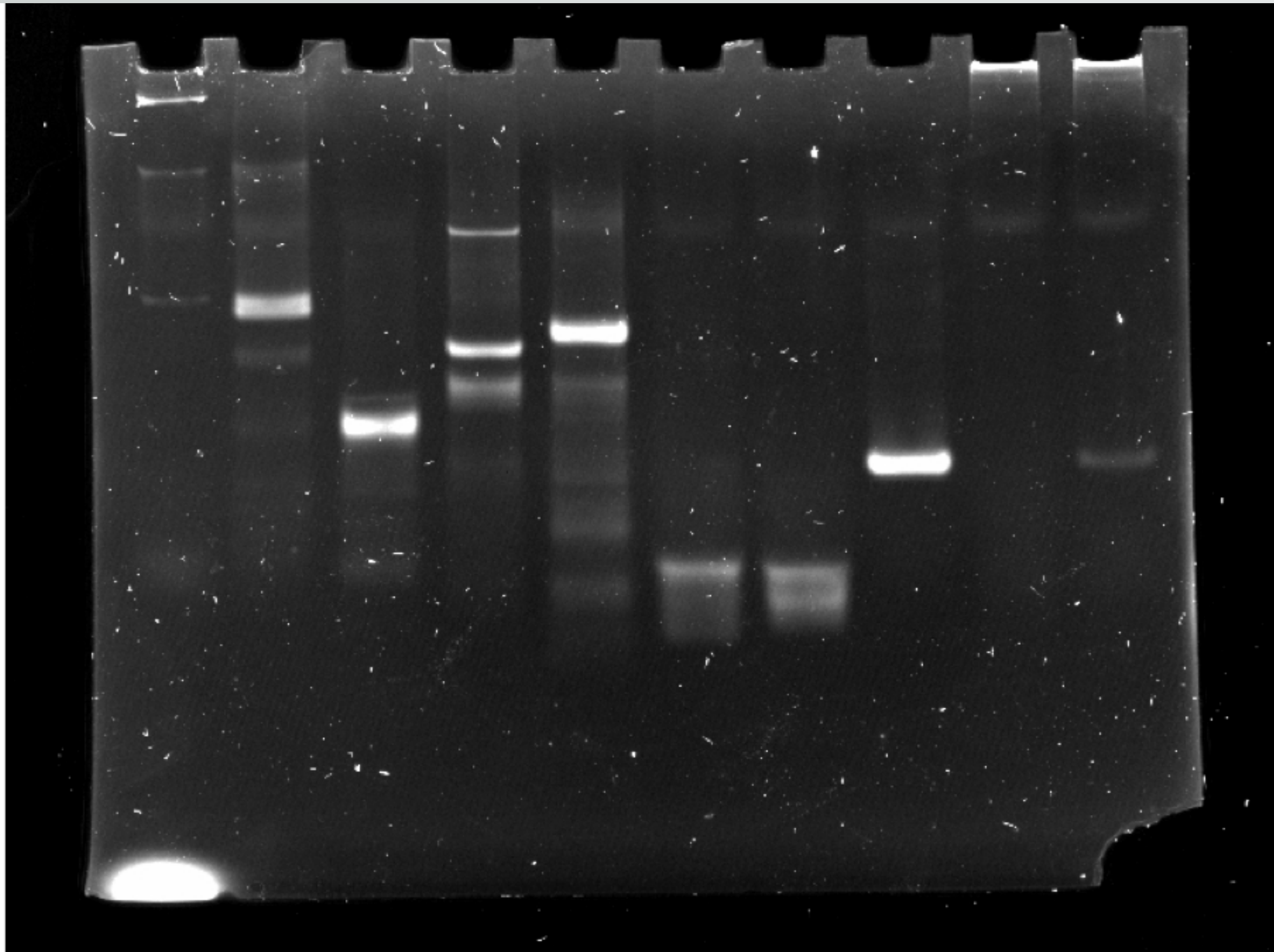
Other substances

Bromophenol blue

Cyanol



# Our journey



Loading:  
1uM, 6uL  
w/ self-made Loading Dye  
[Glycerol + Gel Red]  
Staining:  
Gel Red pre-stained in loading dye





The University of Hong Kong 2016





## Special thanks:



香港大學  
THE UNIVERSITY OF HONG KONG

Dr. Julian A. Tanner



Mr. Simon Shiu  
Mr. Jacky Yuen

## The Team:

Lai Hei Wai  
Lau Yui Ching  
Ho Sin Ning Shannon  
Tam Ka Ki Tim  
Lam Yung Shing  
Yung Canaan  
Law Janice Hiu Ching  
Lo Yik Hei  
Na Ri Sha  
Dissanayake Thrimendra  
Chiu Man Ying  
Chan Tak Lok  
Wu Gabriel Tze Chung  
Tsang To  
Chu Ku Yin Alex  
Ng Ka Hei  
Wan Emily Tin Yan  
Kabigtung Jessica

## Student advisors:

Lai Hei Ming  
Lo Yat Kei Tommy  
Pun Hok Sum Thomson

